Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences

CSAS | SCCS

Canadian Science Advisory Secretariat | Secrétariat canadien de consultation scientifique

Research Document 2005/071 | Document de recherche 2005/071

Not to be cited without
Permission of the authors * | Ne pas citer sans
autorisation des auteurs *

Exploitation of Atlantic *cod (Gadus morhua)* in NAFO Subdiv. 3Ps: further updates based on 1997-2004 mark-recapture data.

Taux d'exploitation de la morue franche *(Gadus morhua)* dans la sous-division 3Ps de l'OPANO : suivi de la récupération des étiquettes de 1997 à 2004

John Brattey and Brian Healey

Science Oceans and Environment Branch
Fisheries and Oceans
P. O. Box 5667
St. John's, NL Canada A1C 5X1

* This series documents the scientific basis for the evaluation of fisheries resources in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

* La présente série documente les bases scientifiques des évaluations des ressources halieutiques du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Research documents are produced in the official language in which they are provided to the Secretariat.

Les documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au Secrétariat.

This document is available on the Internet at: Ce document est disponible sur l'Internet à:
http://www.dfo-mpo.gc.ca/csas/

ISSN 1499-3848 (Printed / Imprimé)
© Her Majesty the Queen in Right of Canada, 2005
© Sa majesté la Reine, Chef du Canada, 2005
Canada

106-07443

Abstract

This document updates the results of a multi-year tagging study of Atlantic cod (*Gadus morhua*) in NAFO Subdiv. 3Ps, initiated during spring 1997. Since inception, a total of over 65,400 cod have been tagged with single, double, or high-reward t-bar anchor tags and released at various inshore and offshore sites off southern Newfoundland (3Ps) and 12,603 (19.2%) have been reported as recaptured to 20 September 2005. No new tagging was conducted in the inshore of 3Ps during 2004. Estimates of exploitation for cod tagged in each region in each year were computed using methods reported in our previous document; values for 2005 are preliminary as the fishery was still in progress. Estimates of short-term tagging mortality, tag loss, and reporting rate were obtained and are incorporated into the estimation. Among cod tagged in Placentia Bay (3Psc) mean annual estimates of exploitation have declined from 34% in 1999 to 20% in 2004. For cod tagged in Fortune Bay (3Psb) mean annual estimates have been similar (10-11%) during 2000-2003, but declined slightly to 8.1% in 2004, with tag returns indicating considerable movement of cod between Fortune Bay and Placentia Bay. For cod tagged in 3Psd (Burgeo Bank) the estimate for 2004 was 2.1%, comparable to the 2% estimated for 2003. Mean annual estimates of exploitation for cod tagged in offshore areas (3Psh) remain consistently low (2.2% for 2004 and ranging from 1.5-3.5% during 1998-2003) in spite of offshore landings of >6,000 t. Offshore tagging coverage was again expanded during 2004 with the assistance of industry, and approximately 1,750 tagged cod were released in southern 3Psh during December. To date, 47 of the cod tagged offshore in December have been reported as recaptured. Results were almost identical to those for cod tagged offshore in December in 2003, with recaptures taken either in the local offshore area (3Psh) or within Placentia Bay (3Psc).

Résumé

Le présent document fait le bilan des résultats d'une étude de marquage-recapture pluriannuelle de la morue franche (*Gadus morhua*) dans la sous-division 3Ps de l'OPANO, amorcée au printemps 1997. Depuis le début de cette étude, 65 400 morues, au total, ont été marquées à l'aide d'étiquettes à ancrage en T à récompense simple, double ou élevée, avant d'être remises à l'eau à divers endroits dans les eaux côtières et hauturières au sud de Terre-Neuve (3Ps). Au 20 septembre 2005, 12 603, soit 19,2 % des morues étiquetées avaient été recapturées. Il n'y a eu aucune nouvelle activité de marquage dans la partie côtière de 3Ps en 2004. Des méthodes semblables à celles décrites dans notre document précédent ont été utilisées pour estimer le taux d'exploitation dans chaque région et durant chaque année, sauf que les valeurs pour 2005 sont préliminaires étant donné que la pêche était en cours. L'estimation du taux d'exploitation tient compte du calcul estimatif de la mortalité à court terme due au marquage, du nombre d'étiquettes perdues et du taux de déclaration propre à la région. Dans le cas des morues étiquetées dans la baie de Plaisance (3Psc), le taux annuel moyen d'exploitation a chuté, passant de 34 % en 1999 à 20 % en 2004. Pour les morues étiquetées dans la baie de Fortune (3Psb), les taux annuels moyens estimatifs étaient semblables (10-11 %) de 2000 à 2003, mais ont diminué légèrement à 8,1 % en 2004. D'après les étiquettes récupérées, la morue se déplace beaucoup entre la baie de Fortune et la baie de Plaisance. Le taux d'exploitation de la morue étiquetée dans 3Psd (banc Burgeo) était de 2,1 % en 2004, à peu près comme en 2003 (2 %). Les estimations du taux d'exploitation annuel moyen des morues étiquetées dans les eaux hauturières (3Psh) demeurent toujours faibles (2,2 % pour 2004 et entre 1,5 et 3,5 % entre 1998 et 2003), malgré des prises hauturières de plus de 6 000 t. La couverture du programme d'étiquetage en haute mer a été élargie de nouveau en 2004 avec l'aide de l'industrie, ce qui a permis de relâcher quelque 1 750 morues étiquetées dans le secteur sud de 3Psh en décembre. Jusqu'à maintenant, 47 de ces morues ont été recapturées. Les résultats étaient presque identiques à ceux de la morue marquée en décembre 2003, les recaptures ayant eu lieu soit dans la zone hauturière locale (3Psh) ou dans la baie de Plaisance (3Psc).

Introduction

A mark-recapture study of Atlantic cod (*Gadus morhua*), initiated in NAFO Subdiv. 3Ps during 1997, was updated with recaptures received up to 20 September 2005 from tagged cod released in previous years. The purpose of the study was to provide information on movement patterns of 3Ps cod as well as obtain ongoing estimates of exploitation rates on different components of the stock.

Annual estimates of exploitation are given for each tagging experiment conducted in 3Ps during 1997-2004 using the methods described in Brattey and Healey (2004, 2005). The present document also updates a summary of the spatial and temporal distribution of recaptures of tagged cod released in various regions of Subdiv. 3Ps during April 1997-December 2004. Previous results from post-moratorium cod tagging studies in 3Ps and adjacent areas are reported in Brattey (1999, 2000), Brattey and Healey (2003a, b, 2004), Brattey et al. (1999, 2002a), Lawson et al. (1998), Lawson and Rose 2000, Robichaud and Rose (2001, 2002), Windle and Rose (2005). Historical cod tagging studies (prior to 1994) in the Newfoundland Region are summarized in Taggart et al. (1995), Myers et al. (1996, 1997), Brattey (1996). Methods to estimate tagging mortality, tag loss, and reporting rates from our tagging data are described in Brattey and Cadigan (2004) and Cadigan and Brattey (1999a, b, 2000a, b, 2003a b, 2004).

Materials and Methods

Cod for tagging were captured with various gears (mostly hand-line and otter-trawl), measured (nearest cm) and tagged with one or two t-bar anchor tags inserted at the base of the first dorsal fin, and released. Experienced technicians conducted the tagging. Only cod ≥45 cm (fork length) that appeared healthy were tagged. Each batch of cod typically consisted of individuals tagged with either single, double, or high–reward tags, although double –tagging was discontinued after 1999. The tags were uniquely numbered and bore a return address as well as the value of the reward ($10 for one single, $20 for two singles, or $100 for high-reward). The tagging program was advertised extensively among those participating in the fishery. Details of the tagging experiments are summarised in Table 1. The number of cod tagged annually ranged from about 6,000 to 11,200. The sizes of tagged cod ranged from 45 to about 115 cm with mean lengths mostly in the 55-65 cm range. A total of 61 tagging experiments has been conducted at various sites in 3Ps; most tagging has been conducted on spawning and pre-spawning aggregations at the head of Placentia Bay (3Psc), the head of Fortune Bay (3Psb), off Pass Island in the outer reaches of Fortune Bay, in the Burgeo Bank-Hermitage Channel area (3Psa/d), in the Halibut Channel area (3Psh), and on one occasion off the north-western corner of St. Pierre Bank (3Psd)(Fig. 1). In 2003 and 2004, cod were tagged in the offshore (3Psg/h) during an industry trawl survey conducted in December; these cod were tagged by experienced retired DFO technicians who followed the same protocols used elsewhere in the current study. No tagging has been conducted in the inshore of 3Ps since 2003.

Reported landings of cod from 3Ps (up to September 2004) and from neighbouring management areas in the northern Gulf of St. Lawrence (3Pn4RS) and eastern Newfoundland (3KL) during recent years were extracted from the Statistics Branch catch database and are summarized to aid in the interpretation of tag returns.

Estimation of exploitation rates

Development of the methods used to estimate exploitation rates are described in Brattey and Healey (2003a, 2004). The design of the tagging study incorporates methods to estimate tagging mortality (Brattey and Cadigan 2004), tag loss and reporting rates (Cadigan and Brattey 2003b). Updated estimates of tag loss were incorporated into the estimates, and these showed only minor changes and are also not given here. The instantaneous rate of natural mortality (m) was assumed to be 0.2 per yr (i.e. 82% annual survival rate). Data from tag releases in 1997-2004 and recaptures obtained from 1997 until 20 September 2005 were used herein. As in previous analyses (Brattey and Healey 2003a, b; 2004), we did not attempt to estimate population sizes using tag returns and commercial catches in this analysis, because typically some harvesting occurs in an area different from where fish were tagged; this makes it difficult to convert local catches to local population biomass. Methods to estimate cod biomass from tagging data and catches are presented elsewhere (Lilly et al. 2001; Pope and Brattey 2001; Cadigan and Brattey 2001, 2002, 2003a).

Tagging experiments were conducted in consecutive years in many locations; thus multiple annual estimates of exploitation are given for some locations. Note that in some years tagged fish were released during the fishery and the first estimate of exploitation for these releases accounts for only a portion of the total exploitation in that year.

We also computed mean annual estimates of exploitation for each of the unit areas where fish were tagged. We used recaptures from the year of estimation and two preceding years in calculating these means, which were weighted by the numbers of tagged cod released (i.e. annual means for 2004 were based on recaptures from 2004, 2003 and 2002).

Many of the tagging experiments now have long (> 6 yrs) times at liberty and some of the earliest experiments likely have relatively few tagged cod still available for recapture, due to the combined effects of fishing, natural mortality, and tag loss. The remaining tagged cod from these experiments would also be typically >10 years old, given that they are usually at least age 4 at the time of tagging. The low numbers of tagged cod available for recapture from these older experiments has the potential to cause computational difficulties, i.e. when a tag type was returned from an experiment where the estimated number of that tag type still available for recaptures was small, i.e. <1. To address this problem, during estimation we flagged the number of instances where the remaining numbers of cod tagged with a particular tag type declined to <1, and also flagged instances where more tagged cod were recaptured within a year than were estimated to be available. If such events occurred frequently and involved multiple recaptures across several experiments it could imply that the assumed rate of natural mortality, the estimated rate of tag loss, or estimated reporting rate was incorrect (too high). In the present analyses there were no experiments where the estimated number of a particular tag type declined to <0, but there were several experiments where the estimated number available for recapture declined to <1. These typically involved experiments with small numbers of releases of one or more tag types and long (>5 yr) times at liberty.

Results

Spatial and temporal distribution of cod landings

Reported landings of cod by unit area for NAFO Subdiv. 3Ps from 1997-2004 are summarized in Table 2A and Fig. 2. In most years there were substantial landings (>1,000 t) throughout the stock area except in 3Psg and 3Psd; that latter unit area is closed to directed cod fishing for much of the year. There have been no major changes in the distribution of landings over the past 3-4 years. Highest landings (33-51% of the entire TAC) have come from Placentia Bay (3Psc) (Fig. 2) and reported landings from Placentia Bay in 2004 are similar to those observed in 2002 and 2003. In the offshore, landings have mostly been highest in 3Psf/h, which includes the southern Halibut Channel and the eastern portions of St. Pierre Bank (see Fig. 1). Note that the total annual catches reported herein for some years exclude catches where unit area was not reported and are therefore slightly lower than the totals reported in Brattey et al. (2004).

Reported annual landings by unit area for adjacent management areas are reported in Table 2B (NAFO Divs. 3KL) and Table 2C (Subdiv. 3Pn and Divs. 4RS). The TAC's in these adjacent management units have been smaller than those in 3Ps (typically 3,000-9,000 t). In most years, the highest landings per unit area from the northern Gulf stock have come from Subdiv. 3Pn, and unit areas 4Ra and 4Rb. From the northern cod stock area (Divs. 2J+3KL), highest landings have come well to the north of 3Ps from unit areas 3Ki, 3La and 3Lb; annual landings in each of the unit areas in southern 3L (3Lf/j/q) have typically been low (<700 t). A moratorium on directed cod fishing in both of these adjacent management areas was re-introduced during 2003/04 and is clearly reflected in the lower landings. However, in 2004/05 the fishery on the northern Gulf stock was reopened with a TAC of 3,500 t; the distribution of landings in 2004/05 is similar to that described above for the 1997-2002 period.

Numbers of recaptures

A matrix of the numbers of tagged cod reported as recaptured annually (for all tag types combined) up to 20 September 2005 is given by tagging experiment in Table 3. As in previous years, there have been substantial numbers of recaptures from most inshore tagging experiments, particularly those conducted in Placentia Bay during spring. Offshore tagging (Halibut Channel, Hermitage Channel, Burgeo Bank, NW St. Pierre Bank) has tended to generate substantially fewer recaptures. Tags have been returned from some experiments 6 years after release, although the numbers of returns have declined to zero in some of the earliest experiments conducted in 1997 and 1998.

Exploitation estimates

Annual estimates of exploitation (expressed as % of available numbers harvested) for each tagging experiment are summarized and grouped by unit area of release in Table 4. Note that the values for years prior to 2004 have been revised slightly from those reported in Brattey and Healey (2004); these differences reflect slight changes in the estimates of reporting rate and recovery of a few additional tags from previous years. Values for 2005 for all experiments are preliminary as the fishery was still in progress.

The number of cod tagged has been too low in the western portion of the inshore (i.e. 3Psa) to draw firm conclusions about exploitation of cod tagged in that region. Among cod tagged in Fortune Bay, annual estimates for 2004 have, as in 2003, tended to be lower for cod tagged at Pass Island (0.8 – 7.0%) compared to those tagged at Poole's Cove (5.7 – 15.8%). Overall, the results indicate lower exploitation during 2004 compared to 2003, with no individual estimates exceeding 16.0% in 2004 compared with several over 20% in 2003. The overall annual mean for cod tagged in 3Psb in 2004 (8.1%) was slightly lower than the 2003 estimate (10.4%).

Among cod tagged in Placentia Bay, annual estimates of exploitation have been much higher than those for cod tagged in other regions of 3Ps, particularly during 1999 and 2000 when both the overall TAC and landings in Placentia Bay were highest (see Fig. 2). Annual estimates increased from 14-15% exploitation during 1997-1998 to a maximum of 34.4% during 1999 followed by a decline during subsequent years. The mean annual estimate of exploitation in 2004 for cod tagged in Placentia Bay (20%) is the lowest observed since 1998.

Note that not all of the exploitation of cod tagged in 3Psc occurs in Placentia Bay itself (see Table 5). Reductions in catch from the cod fishery in adjacent 3KL during 2003 to 2004 may also have lowered the estimates for Placentia Bay tagging because some of the cod tagged in Placentia Bay are known to migrate across the stock boundary into southern 3L. Also, the 2003 exploitation estimates from cod tagged in 3Psc prior to the spring of 1999 are based on very few recaptures (<5) and are consistently low; this may reflect growth and reduced selection of the available tagged fish from these experiments; most of these fish may have grown beyond the optimum selection size of gillnets which account for most of the catch. These older recaptures were therefore not included when calculating annual means. There are no recaptures from some of the oldest tagging experiments (1997 and 1998), suggesting that the tagged population from these experiments has now declined to very low numbers; this is not surprising given that any survivors would mostly be at least 12 years old and they have been fished quite heavily for the past six years.

Among cod tagged in 3Psd since 1998, estimates of exploitation have been consistently low and notably lower than those observed in 3Psc and 3Psb, with annual means ranging from 9.1% in 1999 to only 1.9% in 2003. The individual estimates for both 2003 and 2004 were all low (1.9% to 2.1%). Many of the cod tagged in this region in recent years have subsequently been recaptured in western 3Ps or in 3Pn4RS; however, reopening of the northern Gulf cod fishery with a TAC of 3,500 t has not resulted in a notable increase in exploitation rate of cod tagged in 3Psd. Management measures have reduced the winter cod landings from 3Psd (and 3Psa) in 2003 and 2004 (see Table 2).

Mean annual estimates of exploitation have consistently been lowest among cod tagged in Halibut Channel (3Psh) during April, with values ranging from 1.7-3.5% and little variation among individual experiments in spite of substantial landings, particularly in 2000 (see Fig. 2). The estimates for 2004 are again low in spite of substantial offshore landings. In 2003 and 2004, tagging was also conducted in 3Psh and 3Psg in December to improve the coverage of this offshore region; however, only 29 of 999 (2.9%) from the 2003 tagging, and 48 of 1747 (2.7%) from the 2004 tagging have been reported as recaptured as of 20 September 2005. Early indications are that both the numbers (Table 3) and locations of recapture (Figs. 4A and 4B) are similar to those observed for cod tagged in this region in April (Fig. 3H). Notably, there have been no reported recaptures from

the northern Gulf stock area. Most recaptures have come from the winter otter trawl fishery close to where tagged cod were released, from the summer inshore fishery in Placentia Bay, southern St. Pierre Bank, or more rarely inshore around the Avalon Peninsula.

Spatial and temporal distribution of recaptures

Annual summaries of the distribution of recaptures, grouped by unit area and year of release and adjusted by reporting rates, are given in Table 5; in addition, plots showing the annual distribution of recaptures (only for tags where exact recapture positions were reported) by unit area of release are shown in Figs. 3A-3H, Figs. 4A-4B; these plots include data from tagging experiments in neighbouring 3L (Figs. 3A-3D) as some of these experiments resulted in recaptures within 3Ps. Details of the tagging experiments conducted in 3KL are given in Brattey and Healey (2005). The distribution of recaptures indicates in a general sense where the exploitation of cod tagged in each region subsequently takes place; we emphasized that the distribution of recaptures is strongly influenced by changes in landings (Tables 2A, 2B, 2C).

Data are limited for 3Psa, but two small experiments involving a total of only 64 cod tagged have generated a small number of inshore recaptures in 3Ps west of the Burin Peninsula, with one offshore recapture in Halibut Channel (data not shown here – see Brattey and Healey 2004, Fig 3.1).

Most cod tagged near Pass Island, Poole's Cove, and other locations in Fortune Bay, show strong inshore residency even among recaptures taken several years later, with most recoveries coming from within Fortune Bay or eastward into neighbouring Placentia Bay (Fig. 3F). There is little evidence of westward movement of these cod with only a few recaptures from 3Pn4RS especially from experiments conducted later in spring (late May). These experiments may have included some migrant fish from areas to the west. Small proportions of cod tagged in Fortune Bay have also been recovered from more distant regions such as southern 3L, offshore 3Ps, and 3Pn4RS, but in general there are no strong indications of any progressive dispersal away from the tagging region over time. For cod tagged in Fortune Bay, the results indicate that typically 20-40% of the recaptures (Table 5) and hence a substantial portion of the exploitation takes in neighbouring Placentia Bay.

Cod have been tagged offshore in 3Psd (Hermitage Channel and the southern edge of Burgeo Bank) in April on several occasions over a five year period (Fig. 3G); the exception was 2000 when no significant aggregations were located. The overall numbers recaptured have tended to be low except from the 1998 and 2001 releases; consequently, many of the percentages are based on small sample sizes, particularly in 2002 and 2003. Nonetheless, many of the tagged cod dispersed widely from the tagging area and these cod are therefore exploited in several regions. The distribution of recaptures extended west and northward into 3Pn4RS as far north as the Strait of Belle Isle (4Ra) often within 3 months of release. Others migrated inshore and eastward along the south coast of Newfoundland into unit areas 3Psa, 3Psb, and 3Psc, and more rarely into southern 3L. The proportion of recaptures from 3Pn4RS relative to 3Ps has varied annually. Few of the cod tagged in the Burgeo Bank-Hermitage Channel area have been recaptured on the southeast corner of St. Pierre Bank, or in Halibut Channel, in spite of substantial landings, suggesting little inter-mixing between cod tagged in these two offshore regions during April. The lack of recaptures close to the tagging site in 3Psd can be attributed at least partly to closures of this over-wintering region to directed cod fishing during 15 November-15 April in recent years.

Cod have been tagged offshore in Halibut Channel (3Psh) during April in five consecutive years. (see Fig. 3H and Table 5). Exploitation of these cod has taken place mainly in three areas: (1) the slope edge at the bottom of Halibut Channel close to the area of release (3Psh), (2) shallow water on the south-east corner of St. Pierre Bank in unit areas (3Psf and 3Psh), or (3) inshore in Placentia Bay (3Psc) and more rarely around the Avalon Peninsula (3Lj/q/f). A few cod tagged in this region have also been reported from more distant regions (i.e. single recoveries from 3K and 4R). Overall, the distribution of recaptures has been consistent. There have consistently been few recaptures from the western portion of the inshore of 3Ps (i.e. 3Psa and 3Psb) in spite of substantial landings (see Table 2A, Fig. 2). Furthermore, there has been only a single recapture from the northern Gulf of St. Lawrence stock area (3Pn4RS) from >8,000 releases in 3Psg/h over the past 6 years.

Cod tagged in Placentia Bay (Fig. 3E) have mostly been exploited inshore within Placentia Bay or in neighbouring Fortune Bay. Typically over 80% of the recoveries have come from within Placentia Bay itself, even several years after tagging (Table 5). In each year, small proportions of recaptures have come from southern 3L, particularly in 1999, and more rarely northern 3L (i.e. 3La, 3Lb) or 3K. Most tagging experiments in Placentia Bay in spring have also resulted in a small number of recaptures clustered at the slope edge at the bottom of the Halibut Channel, or scattered across St. Pierre Bank. However, the number of reported offshore recaptures from Placentia Bay tagging has been small in spite of substantial offshore landings (see Table 2A, Fig. 2).

Discussion

Our findings continue to be consistent with results given in our previous documents (Brattey et al. 2002a, Brattey and Healey 2003a, b, 2004), and indicate restricted mixing of cod from different portions of the 3Ps stock area as well as higher exploitation of adult cod tagged inshore, particularly in Placentia Bay. A strong inshore residency persists among fish tagged in spring in Fortune Bay and Placentia Bay, although these fish appear to disperse mainly in an eastward direction along the inshore during summer. Recaptures from cod tagged inshore has extended into 3L in some years, but this continues to be difficult to quantify in recent years with the closure of the directed fishery in 2J+3KL and a corresponding reduction in tag returns. There continues to be limited offshore movement of cod tagged inshore with only a few offshore recaptures even several years after release. The inshore sub-components, particularly those in Placentia Bay, are supplemented during late spring, summer, and fall by seasonal migrants from various offshore areas. The tagging shows that the inshore catch includes a mixture of inshore cod as well offshore cod from Burgeo Bank, St. Pierre Bank, and the Halibut Channel. In contrast, the offshore catch (3Ps/e/f/g/h) appears to be comprised mainly of fish that reside on St. Pierre Bank and in Halibut Channel throughout the year, although small numbers of inshore-tagged cod are recaptured in the offshore during winter in most years.

Our estimates of overall exploitation for cod tagged in the Burgeo region (3Psd) continue to be low and suggest that cod present in this area at that time, irrespective of their stock affinity, have not been heavily exploited. Any removals of migrant 3Pn4RS cod from 3Psd in the past three management years will therefore be small and have little influence on the dynamics of that stock. Reopening of the northern Gulf cod fishery in 2004/05 to date appears to have had little influence on estimates of

exploitation rate for cod tagged in 3Psd, although values given in Table 4 for 2005 include only a portion of the current (2005) fishery.

Cod tagged in Placentia Bay continue to be more heavily exploited than those in most other regions. Catch rate indices from the sentinel fishery and from logbooks for the <35' sector in Placentia Bay declined after the fishery reopened in 1997, and have remained at a low level over the past several years (Brattey et al. 2004), suggesting that current exploitation rates are still too high and may be preventing the rebuilding of this component of the stock. In contrast, corresponding catch rate indices for Fortune Bay (3Psb) as a whole have been quite stable at a reasonably high level in recent years and exploitation rates have been consistently been much lower at around 8-11%. These comparisons indicate some consistency in the relationship between exploitation rates and trends in local catch rates.

Compared with other regions in 3Ps, the estimates of exploitation for the offshore areas continue to be much lower, in spite of substantial offshore landings of over 6,000 t per annum in the past several years (Fig. 2). In the previous analyses (Brattey et al. 2002a, Brattey and Healey 2003b, 2004) concerns were expressed that the estimates for the offshore may be more uncertain because of the sparseness of the tagging coverage, depth of capture of cod for tagging, and limited spatial extent of activity in the offshore fishery. We have again attempted to address these by conducting more tagging offshore during December for a second time as part of the industry trawl survey (see McClintock 2004, 2005). Results to date continue to show low exploitation of these cod, and agree with findings from spring tagging, with only a small percentage (1-2%) recaptured and these taken offshore near the tagging site or inshore in Placentia Bay. We believe it would be useful to continue with the offshore tagging coverage to improve our estimates of reporting rate from this region and therefore further reduce the uncertainty around our estimates of offshore exploitation.

Acknowledgements

We thank the sentinel and commercial fishers and staff of the Fisheries Evaluation, Gadoids, and Commercial Sampling Sections of DFO Newfoundland Region for conducting the tagging experiments; graduate students working under the chair of Fisheries Conservation, Memorial University, conducted some of the tagging in 1997. Bruce Chapman assisted with development of the offshore industry tagging initiative, and Bob Ennis supervised and tagged cod during the industry offshore trawl surveys. Clyde George, D. Porter, P. Upward collated the release and recapture information. We also gratefully acknowledge the assistance of Fisheries Officers and Observers in implementing the tagging program, and thank the numerous fishers and plant workers for returning tags and recapture information. This study was funded by the DFO mainly under the Strategic Science Fund program.

References

Brattey, J. 1996. Overview of Atlantic cod (*Gadus morhua*) stock structure in NAFO Subdivision 3Ps inferred from tagging studies. DFO Atlantic Fisheries Research Document 96/93.

Brattey, J. 1999. Stock structure and seasonal migration patterns of Atlantic cod (*Gadus morhua*) based on inshore tagging experiments in Divs. 3KL during 1995-97. DFO Canadian Stock Assessment Secretariat Research Document 99/103.

Brattey, J. 2000. Stock structure and seasonal movements of Atlantic cod (*Gadus morhua*) in NAFO Divs. 3KL inferred from recent tagging experiments. DFO Canadian Stock Assessment Secretariat Res. Doc. 2000/084.

Brattey, J. and B. P. Healey. 2003a. Exploitation rates and movements of Atlantic cod (*Gadus morhua*) in NAFO Divs. 3KL based on tagging experiments conducted during 1997-2002. DFO Can. Sci. Advis. Sec. Res. Doc. 2003/032.

Brattey, J. and B. P. Healey. 2003b. Updated estimates of exploitation from tagging of Atlantic cod *(Gadus morhua*) in NAFO Subdiv. 3Ps during 1997-2003. DFO Can. Sci. Advis. Sec. Res. Doc. 2003/091.

Brattey, J., and N. G. Cadigan. 2004. Estimation of short-term tagging mortality of adult Atlantic cod (*Gadus morhua*). Fisheries Research 66: 223-233.

Brattey, J., B. Healey. 2004. Exploitation of Atlantic cod (*Gadus morhua*) in NAFO Subdiv. 3Ps: further updates based on tag returns during 1997-2004. DFO Can. Sci. Advis. Sec. Res. Doc. 2004/084.

Brattey, J., B. Healey. 2005. Exploitation and movements of Atlantic cod (*Gadus morhua*) in NAFO Divs. 3KL: further updates based on tag returns during 1995-2004. DFO Can. Sci. Advis. Sec. Res. Doc. 2005/047.

Brattey, J., G. Lawson, and G. Rose. 1999. Seasonal migration patterns of Atlantic cod (*Gadus morhua*) in Subdivision 3Ps based on tagging experiments during 1997-1998. DFO Can. Sci. Advis. Sec. Res. Doc. 99/37.

Brattey, J., D. R. Porter, and C. W. George. 2002a. Exploitation rates and movements of Atlantic cod (*Gadus morhua*) in NAFO Subdiv. 3Ps based on tagging experiments conducted during 1997-2001. DFO Can. Sci. Advis. Sec. Res. Doc. 2002/003.

Brattey, J., N. G. Cadigan, B. P. Healey, G. R. Lilly, E. F. Murphy, D. E. Stansbury, and J.-C. Mahé. 2003. An assessment of the Atlantic cod (*Gadus morhua*) stock in NAFO Subdivision 3Ps in October 2003. DFO Can. Sci. Advis. Sec. Res. Doc. 2003/092.

Brattey, J., N.G. Cadigan, B.P. Healey, G.R. Lilly, E.F. Murphy, P.A. Shelton, J.-C. Mahé. 2004. An assessment of the Atlantic cod (*Gadus morhua*) stock in NAFO Subdivision 3Ps in October 2004. DFO Can. Sci. Advis. Sec. Res. Doc. 2004/083.

Cadigan, N. G. and J. Brattey. 1999a. Tag loss and reporting rates for 1997 and 1998 cod tagging experiments in 3Psc and 3KL. DFO Canadian Stock Assessment Secretariat, Research Document 99/65.

Cadigan, N. G. and J. Brattey. 1999b. Estimation of exploitation and migration rates of Atlantic cod (*Gadus morhua*) in Subdiv. 3Ps and Divs. 3KL during 1997 and 1998 based on tagging experiments. DFO Canadian Stock Assessment Secretariat, Research Document 99/38.

Cadigan, N., and J. Brattey. 2000a. Lower bounds on the exploitation of Atlantic cod (*Gadus morhua*) in NAFO Divs. 3KL and Subdiv. 3Ps in 1997-1999 from tagging experiments. DFO Canadian Stock Assessment Secretariat, Research Document 2000/073.

Cadigan, N. G. and J. Brattey. 2000b. Estimation of cod growth in Subdiv. 3Ps and Divs. 3KL in 1997-1999 from tagging experiments. DFO Canadian Stock Assessment Secretariat, Research Document 2000/074.

Cadigan, N., and J. Brattey. 2001. Estimation of exploitation rates and migration rates for cod (*Gadus morhua*) in NAFO Divisions 3KL and Subdiv. 3Ps during 1997-2000 from tagging experiments. ICES CM 2001/O:4.

Cadigan, N. G. and J. Brattey. 2002. Updated estimates of exploitation rates and biomass for cod (*Gadus morhua*) in NAFO Divisions 3KL and Subdivision 3Ps during 1997-2000 from tagging experiments in these years. DFO Can. Sci. Advis. Sec. Res. Doc. 2002/021.

Cadigan, N., and J. Brattey. 2003a. Analyses of stock and fishery dynamics for cod in 3Ps and 3KL based on tagging studies in 1997-2002. DFO Can. Sci. Advis. Sec. Res. Doc. 2003/037.

Cadigan, N., and J. Brattey. 2003b. Semi-parametric estimation of tag loss and reporting rates for tag-recovery experiments using exact time-at-liberty data. Biometrics 59: 869-876.

Lawson, G. L., G. A. Rose, and J. Brattey. 1998. Movement patterns of inshore cod in Subdivision 3Ps (southern Newfoundland) based on mark-recapture studies during 1996/97. DFO Can. Sci. Advis. Sec. Res. Doc. 98/24.

Lawson, G. L., and G. A. Rose. 2000. Seasonal distribution and movements of coastal cod (*Gadus morhua* L.) in Placentia Bay, Newfoundland. Fish. Res. 49: 61-75.

Lilly, G. R., P. A. Shelton, J. Brattey, N. Cadigan, E. F. Murphy, D. E. Stansbury. 2001. An assessment of the cod stock in NAFO Divisions 2J+3KL. DFO Canadian Stock Assessment Secretariat, Res. Doc. 2001/044.

McClintock, J. 2004. Cod catch results 2003: year seven of the NAFO Subdivision 3Ps fall GEAC surveys . DFO Can. Science Advisory Sec. Res. Doc. in prep.

McClintock, J. 2005. Cod catch results 2004: year eight of the NAFO Subdivision 3Ps fall GEAC surveys . DFO Can. Science Advisory Sec. Res. Doc. in prep.

Myers, R. A., N. J. Barrowman, J. M. Hoenig, and Z. Qu. 1996. The collapse of cod in eastern Canada: the evidence from tagging data. ICES J. Mar. Sci. 53: 629-640.

Myers, R. A., N. J. Barrowman, and J. A. Hutchings. 1997. Inshore exploitation of Newfoundland Atlantic cod (*Gadus morhua*) since 1948 as estimated from mark-recapture data. Can. J. Fish. Aquat. Sci. 54: 224-235.

Pope, J. and J. Brattey 2001. A charmingly simple tagging model. DFO Can. Sci. Advis. Sec. Res. Doc. 2001/082.

Robichaud, D., and Rose, G. A. 2001. Multiyear homing of Atlantic cod to a spawning ground. Can. J. Fish. Aquat. Sci. 58: 2325-2329.

Robichaud, D., and Rose, G. A. 2002. The return of cod transplanted from a spawning ground in southern Newfoundland. ICES J. Mar. Sci. 59: 1285-1293.

Taggart, C. T., P. Penney, N. Barrowman, and C. George. 1995. The 1954-1993 Newfoundland cod-tagging data base: statistical summaries and spatial-temporal distributions. Canadian Technical Report of Fisheries and Aquatic Sciences 2042: 441p.

Windle, M.J.S., and G. A. Rose. 2005. Migration route familiarity and homing of transplanted Atlantic cod (*Gadus morhua*). Fisheries Research 75: 193-199.

Table 1. Summary of details for cod tagging experiments conducted in NAFO Subdiv. 3Ps during 1997-2003 (PB=Placentia Bay, FB=Fortune Bay, HB=Hermitage Bay).

Year & expt no.	DFO Stat. area	Area of release	Dates	Gear	Depth (m)	Number tagged	Mean length (cm)
1997-001	3Psc	Bar Haven, NW PB	9-12 Apr.	handline	48-60	996	62.1
1997-002	3Psc	Clattice Hbr., NW PB	10 Apr.	handline	58-60	966	52.3
1997-004	3Psc	Bar Haven, NW PB	17-18 May	handline	50	817	65.0
1997-005	3Psc	St. Bride's, SE PB	25-28 May	handline	40	709	66.4
1997-006	3Psc	Oderin Bank, W PB	24-26 Jun.	handline	40	963	58.9
1997-008	3Psc	Lord's Cove, SW PB	25 Jun -18 Jul.	trap/handline	18-40	793	53.5
1997-015	3Psc	Iona Islands, E PB	6-8 Nov.	handline	30-50	778	61.3
1998-001	3Psh	Halibut Channel	2-5 Apr.	otter trawl	181-307	1842	63.9
1998-002	3Psd	Hermitage Channel	5-7 Apr.	otter trawl	231-344	1352	53.9
1998-003	3Psc	Bar Haven, NW PB	22-25 April	handline	21-50	2073	61.0
1998-004	3Psc	Paradise Sound, W PB	27-29 April	otter trawl	151-206	1212	60.8
1998-005	3Psc	Wareham Rock, NW PB	May 1-3	handline	41-53	1037	61.9
1998-006	3Psb	Pool's Cove, FB	May 20-29	handline	67	938	57.5
1998-007	3Psc	Bar Haven, NW PB	19-24 Oct.	h'line/otter trl.	41-60	511	60.3
1998-008	3Psc	Eastern Channel, PB	17-22 Oct.	handline	52-80	883	58.8
1999-003	3Psb	South of Pass Island, FB	8 Apr.	otter trawl	211-217	1293	57.0
1999-004	3Psc	head of Placentia Bay	29 Apr.-7 May	handline	20-70	2422	63.2
1999-002	3Psd	Hermitage Channel	4-7 Apr.	otter trawl	192-322	464	59.8
1999-001	3Psh	Halibut Channel	1-3 Apr.	otter trawl	149-239	1808	68.0
1999-039	3Psc	head of Placentia Bay	8-17 Nov	h'line/otter tr'l	50	2152	63.0
1999-043	3Psa	Hermitage Bay	30 Nov-1 Dec	handline	50	57	52.9
2000-001	3Psh	Halibut Channel	1-7 Apr	otter trawl	203-259	1044	85.8
2000-003	3Psd	Burgeo Bank	4-Apr	otter trawl	212-318	5	77.0
2000-004	3Psb	Pass Island	5-7 Apr	otter trawl	136-220	1665	53.1
2000-006	3Psb	Pool's Cove, FB	17-19 Apr	line-trawl	60-112	752	55.0
2000-007	3Psc	inner Placentia Bay	26 Apr - 6 May	handline	16-50	2494	60.5
2000-008	3Psc	inner Placentia Bay	27 Apr - 4 May	otter trawl	30-107	528	59.2
2000-033	3Psc	Bar Haven, PB	5-12 Nov.	handline	33-55	1165	59.0
2000-034	3Psc	Saturday Ledge, PB	10-12 Nov.	otter trawl	35-55	792	58.7
2000-035	3Psc	Eastern Channel, PB	13-15 Nov.	handline	35-63	1212	58.7
2001-001	3Psb	Pool's Cove, FB	9-11 Jan.	handline	55-92	200	57.5
2001-002	3Psb	Pool's Cove, FB	9-11 Jan.	linetrawl	73-92	388	56.1
2001-003	3Psh	Halibut Channel	12-14 Apr.	otter trawl	170-248	1144	80.8
2001-006	3Psd/a	Burgeo Bank	15-17 Apr.	otter trawl	179	999	53.8
2001-007	3Psd	NW St. Pierre Bank	16-17 Apr.	otter trawl	186-193	666	89.0
2001-008	3Psb	Pass Island, FB	18 Apr	otter trawl	178-224	477	54.8
2001-009	3Psb	Fortune Bay	25-26 Apr.	handline	50-185	60	52.8
2001-010	3Psc	inner Placentia Bay	28 Apr.-6 May	otter trawl	35-230	1704	57.1
2001-011	3Psc	inner Placentia Bay	28 Apr.-7 May	handline	30-60	2273	58.7
2002-001	3Psb	Pool's Cove, FB	8-10 Jan.	handline	31-69	408	54.2
2002-002	3Psb	Pool's Cove, FB	8-10 Jan.	linetrawl	60-76	223	55.4
2002-003	3Psh	Halibut Channel	11-18 Apr.	otter trawl	150-279	1509	56.5
2002-004	3Psb	Pass Island, FB	13-14 Apr.	otter trawl	219-239	1792	54.0
2002-006	3Psd	SE Burgeo Bank	14-15 Apr.	otter trawl	136-369	963	64.8
2002-007	3Psc	inner Placentia Bay	27 Apr.-7 May	handline	20-45	1832	55.5
2002-008	3Psc	inner Placentia Bay	28 Apr.-7 May	otter trawl	17-48	1399	56.4
2002-012	3Psb	Grand Bank, FB	18 Jun.	handline	67	138	52.0
2002-024	3Psc	inner Placentia Bay	12-18 Nov.	handline	29-51	1676	55.6
2003-002	3Psh	Halibut Channel	12-13 Apr.	otter trawl	184-295	133	53.4
2003-003	3Psb	Pass Island, FB	14-15 Apr.	otter trawl	208-231	1481	52.2
2003-004	3Psd	Burgeo Bank	15-16 Apr	otter trawl	277-347	878	63.0
2003-005	3Psc	Placentia Bay	28 Apr.-11 May	handline	14-70	3427	55.5
2003-006	3Psb	Fortune Bay	16-22 Jun.	hand-line	39-80	1384	54.0
2003-007	3Psb	Fortune Bay	16-22 Jun.	h'line/otter trawl	34-160	630	54.4
2003-008	3Psc	Placentia Bay	11-18 Nov.	handline	39-65	1645	55.4
2003-009	3Psc	Placentia Bay	18-19 Nov.	otter trawl	74-145	634	53.6
2003-010	3Psh	Halibut Channel	9-10 Dec.	otter trawl	150-161	488	60.4
2003-011	3Psg	South St. Pierre Bank	10-Dec.	otter trawl	123-138	511	59.8
2004-002	3Psh	Halibut Channel	12-14 Dec.	otter trawl	138-157	1747	61.7

Table 2A. Reported landings of cod from unit areas in NAFO Subdiv. 3Ps during 1997-2004. (landings for 2004 are to 1 October as the fishery was still in progress).

Year	3Psa	3Psb	3Psc	3Psd	3Pse	3Psf	3Psg	3Psh	Totals
1997	1,191	1,791	4,956	256	110	90	0	1,314	9,708
1998	1,573	2,428	7,102	1,274	698	1,108	377	4,713	19,274
1999	2,697	3,206	11,654	873	360	2,856	804	2,109	24,558
2000	1,718	2,263	8,774	249	1,003	3,183	156	7,742	25,087
2001	1,273	2,398	5,853	343	262	1,404	120	3,349	15,002
2002	1,353	2,302	4,892	356	1,389	1,144	92	3,292	14,819
2003	1,328	2,536	4,825	234	1,401	1,358	171	3,408	15,261
2004	1,403	2,113	4,388	429	831	1,239	202	3,809	14,414

Table 2B. Reported landings of cod from inshore unit areas in NAFO Divs. 3KL during 1998-2003. Most of the landings in 3Lb during 2003 were from a fish kill in Smith Sound, Trinity Bay during April. Total reported offshore landings have been < 50 t per annum.

Year	3Ka	3Kd	3Kh	3Ki	3La	3Lb	3Lf	3Lj	3Lq	Totals
1998	5	122	661	1,331	1,113	649	411	402	147	4,840
1999	24	205	1,100	2,299	1,462	1,686	702	698	268	8,444
2000	13	57	204	1,188	1,477	1,442	398	451	211	5,441
2001	27	184	440	1,117	1,546	2,042	592	486	434	6,868
2002	8	37	133	444	1,150	1,503	304	288	285	4,153
2003	4	6	14	32	74	853	19	11	28	1,041
2004	1	4	26	119	161	140	70	86	23	629

Table 2C. Reported landings of cod from unit areas in NAFO Subdiv. 3Pn and Divs. 4RS during 1997-2004.

Year	3PN	4Rd	4Rc	4Rb	4Ra	4Sv	4Sw	4Sxyz	Totals
1997	2,006	299	593	600	806	141	327	20	4,792
1998	870	636	281	367	387	61	476	33	3,111
1999	1,165	944	908	1,478	1,551	124	632	88	6,890
2000	1,478	800	728	1,439	1,215	180	660	140	6,640
2001	1,740	717	995	1,269	1,310	252	570	81	6,934
2002	1,713	591	795	1,377	1,172	123	686	69	6,526
2003	35	59	14	55	20	19	60	13	276
2004	727	335	288	609	569	97	433	54	3,112

Table 3. Annual summary of reported recaptures (all tag types combined) for cod tagged and released in NAFO Subdiv. 3Ps during 1997-2004 (PB=Placentia Bay, FB=Fortune Bay, HB=Hermitage Bay) and recaptured during 1997-2005.

Year & expt no.	DFO Stat. area	Area of release	Dates of release	Number tagged	Reported recaptures									
					1997	1998	1999	2000	2001	2002	2003	2004	2005	unk'n
1997-001	3Psc	Bar Haven, NW PB	9-12 Apr	996	78	69	72	35	8	3	1	0	0	8
1997-002	3Psc	Clattice Hbr., NW PB	10 Apr	968	91	42	54	26	7	5	4	0	0	6
1997-004	3Psc	Bar Haven, NW PB	17-18 May	817	103	43	84	49	5	5	0	1	0	6
1997-005	3Psc	St. Bride's, SE PB	25-28 May	709	27	46	86	41	8	1	1	1	0	6
1997-006	3Psc	Oderin Bank, W PB	24-26 Jun	963	16	57	36	16	10	1	1	1	0	5
1997-008	3Psc	Lord's Cove, SW PB	25 Jun -16 Jul	794	28	69	50	26	13	3	2	0	0	3
1997-015	3Psc	Iona Islands, E PB	6-8 Nov	784	0	39	89	32	9	2	0	0	0	6
			Total	6029	343	365	471	225	60	20	9	3	0	3
1998-001	3Psh	Halibut Channel	2-5 Apr	1842		24	23	16	7	4	2	0	2	3
1998-002	3Psd	Hermitage Channel	5-7 Apr	1352		30	50	20	10	3	0	2	0	2
1998-003	3Psc	Bar Haven, NW PB	22-25 April	2073		124	313	141	34	9	4	1	0	16
1998-004	3Psc	Paradise Sound, W PB	27-29 April	1212		152	192	100	20	4	6	1	0	14
1998-005	3Psc	Wareham Rock, NW PB	May 1-3	1037		81	208	91	25	6	6	1	0	13
1998-006	3Psb	Pool's Cove, FB	May 20-29	938		87	91	43	25	13	3	1	0	1
1998-008	3Psc	Bar Haven, NW PB	19-24 Oct	511		6	80	38	22	9	3	1	0	1
1998-009	3Psc	Eastern Channel, PB	17-22 Oct	883		29	103	84	38	19	4	2	0	9
			Total	9846		542	1080	533	181	67	28	9	2	59
1999-001	3Psh	Halibut Channel	1-3 Apr	1806			39	45	20	14	6	4	0	2
1999-002	3Psd	Hermitage Channel	4-7 Apr	464			29	12	2	6	1	0	0	0
1999-003	3Psb	South of Pass Island, FB	8 Apr	1293			76	59	31	18	5	3	0	2
1999-004	3Psc	head of Placentia Bay	29 Apr -7 May	2422			402	275	110	34	14	2	1	31
1999-039	3Psc	head of Placentia Bay	8-17 Nov	2152			68	370	124	44	10	4	1	24
1999-043	3Psa	Hermitage Bay	30 Nov-1 Dec	57			1	6	2	1	0	1	0	0
			Total	8196			615	787	289	117	36	14	2	59
2000-001	3Psh	Halibut Channel	1-7 Apr	1044				2	12	2	2	2	1	0
2000-003	3Psd	Burgeo Bank	4-Apr	5				0	0	0	0	0	0	0
2000-004	3Psb	Pass Island	5-7 Apr	1665				92	45	48	28	7	1	2
2000-006	3Psb	Pool's Cove, FB	17-19 Apr	752				60	63	34	19	4	1	5
2000-007	3Psc	inner Placentia Bay	26 Apr - 6 May	2494				312	272	107	27	9	5	24
2000-008	3Psc	inner Placentia Bay	27 Apr - 4 May	528				65	42	26	15	5	0	5
2030-033	3Psc	Bar Haven, PB	5-12 Nov	1165				43	153	40	15	11	0	7
2000-034	3Psc	Saturday Ledge, PB	10-12 Nov	792				40	79	45	16	3	2	10
2000-035	3Psc	Eastern Channel, PB	13-15 Nov	1212				50	129	40	26	4	3	10
			Total	9657				664	795	340	150	45	13	63
2001-001	3Psb	Pool's Cove, FB	9-11 Jan	200					25	14	8	2	0	0
2001-002	3Psb	Pool's Cove, FB	9-11 Jan	388					52	27	12	4	1	3
2001-003	3Psh	Halibut Channel	12-14 Apr	1144					10	13	7	2	5	1
2001-006	3Psd/a	Burgeo Bank	15-17 Apr	989					56	32	7	7	3	1
2001-007	3Psd	NW St. Pierre Bank	16-17 Apr	666					25	9	3	1	2	1
2001-008	3Psb	Pass Island, FB	18 Apr	477					14	15	10	1	1	0
2001-009	3Psb	Fortune Bay	25-26 Apr	80					4	5	2	2	0	0
2001-010	3Psc	inner Placentia Bay	28 Apr -6 May	1704					216	175	81	21	6	22
2001-011	3Psc	inner Placentia Bay	28 Apr -7 May	2273					326	189	68	18	9	19
2001-025	3Psa	Rameo	1 Aug	7					0	1	0	0	0	0
2001-027	3Psc	inner Placentia Bay	22 Nov	350					5	48	19	5	2	2
			Total	8288					733	528	217	63	29	49
2002-001	3Psb	Pool's Cove, FB	8-10 Jan	408						35	37	10	1	1
2002-002	3Psb	Pool's Cove, FB	8-10 Jan	222						31	19	3	1	1
2002-003	3Psh	Halibut Channel	11-18 Apr	1509						13	14	9	3	0
2002-004	3Psb	Pass Island, FB	13-14 Apr	1792						47	36	24	3	0
2002-006	3Psd	SE Burgeo Bank	14-15 Apr	963						13	7	4	2	0
2002-007	3Psc	inner Placentia Bay	27 Apr -7 May	1832						219	193	64	9	3
2002-008	3Psc	inner Placentia Bay	28 Apr -7 May	1388						188	166	51	16	4
2003-009	3Psc	inner Placentia Bay	18-19 Nov	634							6	22	13	4
2003-010	3Psh	Halibut Channel	9-10 Dec	488							1	6	8	0
2003-011	3Psg	South St. Pierre Bank	10-Dec	511							0	10	4	0
			Total	11211							675	615	187	24
2004-002	3Psh	Halibut Channel	12-14 Dec	1747								1	47	0

Table 4. Annual estimates of exploitation (harvest rates in percent) by experiment for cod tagged in NAFO Subdiv. 3Ps during 1997-2004. Recaptures were adjusted to account for reporting rate and releases were adjusted to account for tagging mortality, tag loss and assumed natural mortality. Darkly shaded cells represent estimates for experiments conducted during the fishing season and account for only a portion of exploitation in the year of release. Lightly shaded boxed cells indicate values used to compute annual means for each area of release. See text for further details.

					Reported landings (t):								
					9,045	19,634	28,111	25,100	16,546	14,810	15,260	15,000	*10,000
DFO Stat area	Year & expt no.	Area of release	Dates	Number tagged	Exploitation rates (% harvested) 1997	1998	1999	2000	2001	2002	2003	2004	*2005
3Psa	1999-043	Hermitage Bay	30 Nov-1 Dec	57			4.0	22.1	18.9	12.6	0.0	21.6	0.0
	2001-025	Ramea	1-Aug	7					0.0	41.1	0.0	0.0	0.0
			Annual means					22.1	18.9	15.7			
3Psb	1998-006	Poole's Cove, FB	20-29 May	938		11.8	25.1	15.3	17.9	13.1	1.8	2.6	0.0
	1999-003	Pass Island, FB	8-Apr	1,293			10.9	10.6	8.3	6.3	2.3	2.0	0.0
	2000-004	Pass Island	5-7 Apr	1,665				8.4	5.9	8.8	6.7	2.9	0.5
	2000-006	Poole's Cove, FB	17-19 Apr	752				13.6	19.4	18.1	13.3	5.7	2.9
	2001-001	Poole's Cove, FB	9-11 Jan	200					26.3	25.6	26.2	10.6	0.0
	2001-002	Poole's Cove, FB	9-11 Jan	388					29.0	29.2	20.8	10.8	3.5
	2001-008	Pass Island, FB	18-Apr	477					4.6	6.5	6.0	0.8	1.0
	2001-009	Fortune Bay	25-26 Apr	60					10.5	16.6	10.3	16.0	0.0
	2002-001	Poole's Cove, FB	8-10 Jan	408						19.4	30.0	15.8	2.2
	2002-002	Poole's Cove, FB	8-10 Jan	222						29.4	32.8	10.2	4.1
	2002-004	Pass Island, FB	13-14 Apr	1,792						3.9	4.2	3.7	0.6
	2002-012	Grand Bank, FB	18-Jun	138						9.6	6.2	11.6	0.0
	2003-003	Pass Island, FB	14-15 Apr	1,481							6.2	7.0	4.5
	2003-006	Fortune Bay	16-22 Jun	1,384							8.1	12.7	6.2
	2003-007	Fortune Bay	16-22 Jun	600							3.9	6.8	2.1
			Annual means			11.8	16.9	11.2	11.3	12.9	10.4	8.1	5.5
3Psc	1997-001	Bar Haven, NW PB	9-12 Apr	996	14.6	19.3	31.1	17.8	11.9	6.8	0.0	0.0	0.0
	1997-002	Clattice Hbr, NW PB	10-Apr	966	11.7	9.8	21.6	15.9	7.1	5.6	5.2	0.0	0.0
	1997-004	Bar Haven, NW PB	17-18 May	817	17.4	13.3	33.9	36.7	0.0	4.3	0.0	0.0	0.0
	1997-005	St. Bride's, SE PB	25-28 May	709	5.8	19.4	55.3	59.6	12.6	25.7	0.0	0.0	0.0
	1997-006	Odeon Bank, W PB	24-26 Jun	963	2.6	12.0	12.9	7.0	1.4	0.0	0.0	0.0	0.0
	1997-008	Lord's Cove, SW PB	25 Jun-18 Jul	791	6.7	22.9	31.0	22.1	9.0	11.4	0.0	0.0	0.0
	1997-015	Iona Islands, E PB	6-8 Nov	778	0.0	12.8	40.1	19.2	11.1	6.2	0.0	0.0	0.0
	1998-001	Bar Haven, NW PB	22-25 Apr	2,003		10.0	37.1	25.7	9.8	2.7	2.3	0.0	0.0
	1998-004	Paradise Sound, W PB	27-29 Apr	1,212		22.0	39.8	40.6	16.7	2.5	14.7	4.0	0.0
	1998-005	Wareham Rock, NW PB	1-3 May	1,037		13.8	48.0	43.8	17.9	3.4	11.9	5.5	0.0
	1998-008	Bar Haven, NW PB	19-24 Oct	511		2.4	38.6	25.4	42.1	19.4	8.0	11.9	0.0
	1998-009	Eastern Channel, PB	17-22 Oct	883		4.6	27.6	30.2	26.1	25.1	8.1	5.3	0.0
	1999-004	inner Placentia Bay	29 Apr - 1 May	2,422			33.7	33.0	25.5	13.8	8.7	1.5	1.0
	1999-039	inner Placentia Bay	9-17 Nov	2,152			6.3	37.7	27.1	16.5	5.2	3.6	1.1
	2000-007	inner Placentia Bay	26 Apr - 6 May	2,444				20.8	29.5	17.5	6.4	3.4	2.4
	2000-008	inner Placentia Bay	27 Apr - 4 May	529				18.7	21.9	21.1	20.2	7.8	0.0
	2000-033	Bar Haven, PB	5-12 Nov	1,168				5.4	30.8	15.9	8.5	8.5	0.0
	2000-034	Saturday Ledge, PB	10-12 Nov	792				8.9	26.7	25.5	15.2	4.2	3.3
	2000-035	Eastern Channel, PB	13-15 Nov	1,212				9.8	26.0	15.3	14.4	3.1	2.9
	2001-010	inner Placentia Bay	28 Apr - 4 May	1,704					22.2	28.7	23.1	9.8	3.3
	2001-011	inner Placentia Bay	26 Apr - 7 May	2,279					24.6	23.5	14.6	5.2	3.3
	2001-027	western Channel, PB	22-23 Nov	958					2.3	33.0	25.2	11.0	5.9
	2002-007	inner Placentia Bay	27 Apr - 1 May	1,832						19.8	28.4	15.9	3.2
	2002-008	inner Placentia Bay	28 Apr - 1 May	1,396						22.8	34.0	18.9	9.7
	2002-024	inner Placentia Bay	12-18 Nov	1,676						6.8	27.7	25.9	4.9
	2003-005	inner Placentia Bay	28 Apr - 11 May	3,427							21.8	21.8	7.8
	2003006	inner Placentia Bay	11-18 Nov	1,645							3.8	19.7	7.5
	2003009	inner Placentia Bay	18-19 Nov	634							1.8	9.3	6.4
			Annual means		14.4	15.0	34.4	30.8	26.5	21.4	23.8	20.0	7.6

cont'd

Table 4. Cont'd.

					Reported landings (t)								
					9,045	19,694	28,111	25,100	16,546	14,819	15,260	15,000	*10,000
DFO Stat. area	Year & expt no.	Area of release	Dates	Number tagged	Exploitation rates (% harvested)								
					1997	1998	1999	2000	2001	2002	2003	2004	*2005
3Psd	1998-002	Hermitage Channel	5-7 Apr	1,352		5.1	8.7	3.9	3.5	1.1	0.0	1.2	0.0
"	1999-002	Hermitage Channel	4-7 Apr	464			10.4	6.5	1.4	5.8	1.1	0.0	0.0
"	2001-006	Burgeo Bank	15-17 Apr	999					11.9	9.6	2.3	3.5	1.6
"	2001-007	NW St. Pierre Bank	16-17 Apr	666					6.3	3.5	1.3	0.5	1.2
"	2002-006	SE Burgeo Bank	14-15 Apr	963						2.5	1.9	1.2	0.8
"	2003-004	Burgeo Bank	15-16 Apr	876							1.9	3.1	1.0
			Annual means			5.1	9.1	4.6	7.8	5.4	1.9	2.1	1.0
3Psh	1998-001	Halibut Channel	2-5 Apr	1,842		2.1	3.1	2.8	1.0	0.5	0.6	0.0	0.6
"	1999-001	Halibut Channel	1-3 Apr	1,808			4.0	6.1	3.4	2.8	1.2	1.5	0.0
"	2000-001	Halibut Channel	1-7 Apr	1,044				0.4	2.5	0.4	0.4	1.1	0.7
"	2001-003	Halibut Channel	12-14 Apr	1,144					1.5	2.4	1.6	0.6	1.5
"	2002-003	Halibut Channel	11-18 Apr	1,509						1.5	1.8	1.5	0.8
"	2003-002	Halibut Channel	12-13 Apr	133							2.3	1.6	2.4
"	2003-010	Halibut Channel	9-10 Dec	488							0.3	2.6	4.7
"	2004-002	Halibut Channel	12-14 Dec	1,747								0.0	5.3
3Psg	2003-011	South St. Pierre Bank	10-Dec	511							0.0	4.0	1.9
			Annual means			2.1	3.5	3.5	2.6	1.5	1.7	2.2	4.4

* based on recorded catch and tags received up to 20 September 2005

Table 4. Annual estimates of exploitation (harvest rates in percent) by experiment for cod tagged in NAFO Subdiv. 3Ps during 1997-2004. Recaptures were adjusted to account for reporting rate and releases were adjusted to account for tagging mortality, tag loss and assumed natural mortality. Darkly shaded cells represent estimates for experiments conducted during the fishing season and account for only a portion of exploitation in the year of release. Lightly shaded boxed cells indicate values used to compute annual means for each area of release. See text for further details.

					Reported landings (t)								
					9,045	19,694	28,111	25,100	16,546	14,819	15,260	15,000	*10,000
DFO Stat. area	Year & expt no.	Area of release	Dates	Number tagged	Exploitation rates (% harvested) 1997	1998	1999	2000	2001	2002	2003	2004	*2005
3Psa	1999-043	Hermitage Bay	30 Nov-1 Dec	57			4.0	22.1	18.9	12.6	0.0	21.6	0.0
"	2001-025	Ramea	1-Aug	7					0.0	41.1	0.0	0.0	0.0
			Annual means					22.1	18.9	15.7	.	.	
3Psb	1998-006	Poole's Cove, FB	20-29 May	938		11.8	25.1	15.3	17.9	13.1	1.8	2.6	0.0
"	1999-003	Pass Island, FB	8-Apr	1,293			10.9	10.6	8.3	6.3	2.3	2.0	0.0
"	2000-004	Pass Island	5-7 Apr	1,665				8.4	5.9	8.8	6.7	2.9	0.5
"	2000-006	Poole's Cove, FB	17-19 Apr	752				13.6	19.4	18.1	13.3	5.7	2.9
"	2001-001	Poole's Cove, FB	9-11 Jan	200					26.3	25.8	26.2	10.6	0.0
"	2001-002	Poole's Cove, FB	9-11 Jan	388					29.0	29.2	20.8	10.8	3.5
"	2001-008	Pass Island, FB	18-Apr	477					4.8	6.5	6.0	0.8	1.0
"	2001-009	Fortune Bay	25-26 Apr	60					10.5	16.6	10.3	16.0	0.0
"	2002-001	Poole's Cove, FB	8-10 Jan	408						19.4	30.0	15.8	2.2
"	2002-002	Poole's Cove, FB	8-10 Jan	222						29.4	32.8	10.2	4.1
"	2002-004	Pass Island, FB	13-14 Apr	1,792						3.9	4.2	3.7	0.6
"	2002-012	Grand Bank, FB	18-Jun	138						9.8	6.2	11.6	0.0
"	2003-003	Pass Island, FB	14-15 Apr	1,481							6.2	7.0	4.5
"	2003-006	Fortune Bay	16-22 Jun	1,384							8.1	12.7	6.2
"	2003-007	Fortune Bay	16-22 Jun	630							3.9	6.8	2.1
			Annual means			11.8	16.9	11.2	11.3	12.9	10.4	8.1	5.5
3Psc	1997-001	Bar Haven, NW PB	9-12 Apr	996	14.6	19.3	31.1	17.8	11.9	6.8	0.0	0.0	0.0
"	1997-002	Clattice Hbr., NW PB	10-Apr	966	11.7	9.8	21.6	15.9	7.1	5.6	5.2	0.0	0.0
"	1997-004	Bar Haven, NW PB	17-18 May	817	17.4	13.3	33.9	36.7	0.0	4.3	0.0	0.0	0.0
"	1997-005	St. Bride's, SE PB	25-28 May	709	5.6	19.4	55.3	59.6	12.6	25.7	0.0	0.0	0.0
"	1997-006	Odenn Bank, W PB	24-26 Jun	963	2.6	12.0	12.9	7.0	7.4	0.0	0.0	0.0	0.0
"	1997-008	Lord's Cove, SW PB	25 Jun-18 Jul	793	8.7	22.9	31.0	22.1	9.0	11.4	0.0	0.0	0.0
"	1997-015	Iona Islands, E PB	6-8 Nov	778	0.0	12.8	40.1	19.2	11.1	6.2	0.0	0.0	0.0
"	1998-003	Bar Haven, NW PB	22-25 Apr	2,073		10.0	37.1	25.7	9.8	2.7	2.3	0.0	0.0
"	1998-004	Paradise Sound, W PB	27-29 Apr	1,212		22.0	39.8	40.6	16.7	2.5	14.7	4.0	0.0
"	1998-005	Wareham Rock, NW PB	1-3 May	1,037		13.8	48.0	43.8	17.9	3.4	11.9	5.5	0.0
"	1998-008	Bar Haven, NW PB	19-24 Oct	511		2.4	38.6	25.4	42.1	19.4	8.0	11.9	0.0
"	1998-009	Eastern Channel, PB	17-22 Oct	883		4.0	27.6	30.2	26.1	25.1	8.1	5.3	0.0
"	1999-004	inner Placentia Bay	29 Apr -7 May	2,422			33.7	33.0	26.5	13.8	8.7	1.5	1.0
"	1999-039	inner Placentia Bay	8-17 Nov	2,152			6.3	37.7	27.1	16.5	5.2	3.6	1.1
"	2000-007	inner Placentia Bay	26 Apr - 6 May	2,494				20.8	29.5	17.5	6.4	3.4	2.4
"	2000-008	inner Placentia Bay	27 Apr - 4 May	528				18.7	21.9	21.1	20.2	7.8	0.0
"	2000-033	Bar Haven, PB	5-12 Nov	1,165				5.4	30.8	15.9	8.5	8.5	0.0
"	2000-034	Saturday Ledge, PB	10-12 Nov	792				8.9	26.7	25.5	15.2	4.2	3.3
"	2000-035	Eastern Channel, PB	13-15 Nov	1,212				6.8	26.0	15.3	14.4	3.1	2.9
"	2001-010	inner Placentia Bay	28 Apr -6 May	1,704					22.2	26.7	23.1	9.8	3.3
"	2001-011	inner Placentia Bay	28 Apr -7 May	2,273					24.6	23.5	14.6	5.2	3.3
"	2001-027	western Channel, PB	22-23 Nov	350					2.3	33.0	25.2	11.0	5.5
"	2002-007	inner Placentia Bay	27 Apr - 7 May	1,832						19.8	28.4	15.9	3.2
"	2002-008	inner Placentia Bay	28 Apr - 7 May	1,399						22.8	34.0	18.9	9.7
"	2002-024	inner Placentia Bay	12-18 Nov	1,676						8.8	27.7	25.9	4.9
"	2003-005	inner Placentia Bay	28 Apr -11 May	3,427							21.8	21.8	7.8
"	2003008	inner Placentia Bay	11-18 Nov	1,645							3.6	19.7	7.5
"	2003009	inner Placentia Bay	18-19 Nov	634							1.9	9.3	6.4
			Annual means		14.4	15.0	34.4	30.8	26.5	21.4	23.8	20.0	7.6

cont'd.

Table 4. Cont'd.

					Reported landings (t)								
					9,045	19,694	28,111	25,100	16,546	14,819	15,260	15,000	*10,000
DFO Stat. area	Year & expt no.	Area of release	Dates	Number tagged	Exploitation rates (% harvested)								
					1997	1998	1999	2000	2001	2002	2003	2004	*2005
3Psd	1998-002	Hermitage Channel	5-7 Apr	1,352		5.1	8.7	3.9	3.5	1.1	0.0	1.2	0.0
"	1999-002	Hermitage Channel	4-7 Apr	464			10.4	6.5	1.4	5.8	1.1	0.0	0.0
"	2001-006	Burgeo Bank	15-17 Apr	999					11.9	9.6	2.3	3.5	1.6
"	2001-007	NW St. Pierre Bank	16-17 Apr	666					6.3	3.5	1.3	0.5	1.2
"	2002-006	SE Burgeo Bank	14-15 Apr	963						2.5	1.9	1.2	0.8
"	2003-004	Burgeo Bank	15-16 Apr	878							1.9	3.1	1.0
			Annual means			5.1	9.1	4.6	7.8	5.4	1.9	2.1	1.0
3Psh	1998-001	Halibut Channel	2-5 Apr	1,842		2.1	3.1	2.8	1.0	0.5	0.6	0.0	0.6
"	1999-001	Halibut Channel	1-3 Apr	1,808			4.0	6.1	3.4	2.8	1.2	1.5	0.0
"	2000-001	Halibut Channel	1-7 Apr	1,044				0.4	2.5	0.4	0.4	1.1	0.7
"	2001-003	Halibut Channel	12-14 Apr	1,144					1.5	2.4	1.6	0.6	1.5
"	2002-003	Halibut Channel	11-18 Apr	1,509						1.5	1.8	1.5	0.8
"	2003-002	Halibut Channel	12-13 Apr	133							2.3	1.6	2.4
"	2003-010	Halibut Channel	9-10 Dec	488							0.3	2.6	4.7
	2004-002	Halibut Channel	12-14 Dec	1,747								0.0	5.3
3Psg	2003-011	South St. Pierre Bank	10-Dec	511							0.0	4.0	1.9
			Annual means			2.1	3.5	3.5	2.6	1.5	1.7	2.2	4.4

* based on recorded catch and tags received up to 20 September 2005

Table 5. Annual distribution of recaptures of cod tagged and released in various regions of NAFO Subdiv. 3Ps during 1997-2005. Recaptures were adjusted by region-specific reporting rates estimated from a high-reward tagging study. Shaded cells give the percentage recaptured in the area of release. Values for 2005 are based on tags received to 20 September.

Release Area	Release year	Number tagged	Recapture year	Adj. Nos. recap'd	% of annual recaptures													
					3K	3LA (Bonavista)	3LB (Trinity)	3LF (Concep'n)	3LJ (E. Avalon)	3LO (S. Avalon)	3NO (G. Banks)	3PSA (Burgeo N)	3PSB (Fortune)	3PSC (Placentia)	3PSD (Burgeo S)	3PSOFF (offshore)	4RS3PN (N. Gulf)	UNK
3PSA	1999	57	1999	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
			2000	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85.7	14.3	0.0	0.0	0.0	0.0	0.0
			2001	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
			2002	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
			2004	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
	2001	7	2002	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
3PSB	1998	939	1998	109	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	70.6	17.4	0.0	0.0	4.6	0.0
			1999	115	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	65.2	20.9	0.0	0.0	5.2	1.7
			2000	50	0.0	0.0	0.0	0.0	2.0	0.0	0.0	6.0	70.0	20.0	0.0	2.0	0.0	0.0
			2001	29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.2	51.7	27.6	0.0	0.0	3.4	0.0
			2002	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	93.3	6.7	0.0	0.0	0.0	0.0
			2003	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.7	33.3	0.0	0.0	0.0	0.0
			2004	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
	1999	1293	1999	99	0.0	0.0	0.0	0.0	1.0	1.0	0.0	4.0	28.3	64.6	0.0	1.0	0.0	0.0
			2000	70	0.0	0.0	0.0	4.3	1.4	1.4	0.0	7.1	38.6	40.0	0.0	4.3	2.9	0.0
			2001	36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	19.4	66.7	0.0	2.8	0.0	2.8
			2002	21	0.0	0.0	0.0	0.0	0.0	4.8	0.0	0.0	14.3	66.7	0.0	4.8	9.5	0.0
			2003	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.7	33.3	0.0	0.0	0.0	0.0
			2004	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	0.0	50.0	25.0
	2000	2417	2000	181	0.0	0.0	0.0	0.0	0.6	0.0	0.0	3.3	55.2	34.8	0.0	0.6	1.7	3.9
			2001	128	0.0	0.0	0.0	0.0	0.8	2.3	0.0	3.1	62.5	25.8	0.8	0.8	3.1	0.8
			2002	94	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	48.9	40.4	0.0	1.1	0.0	1.1
			2003	55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.8	34.5	0.0	1.8	0.0	1.8
			2004	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.4	28.6	0.0	0.0	0.0	0.0
			2005	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	0.0	66.7	0.0
	2001	1125	2001	109	0.0	0.0	0.0	0.0	0.9	3.7	0.0	2.8	59.6	31.2	0.0	0.0	0.0	1.8
			2002	71	0.0	0.0	0.0	0.0	0.0	1.4	0.0	5.6	66.2	23.9	0.0	0.0	0.0	2.8
			2003	38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	47.4	44.7	0.0	0.0	2.6	2.6
			2004	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90.0	10.0	0.0	0.0	0.0	0.0
			2005	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
	2002	2560	2002	144	0.0	0.0	0.0	0.0	0.7	0.0	0.0	2.8	54.2	33.3	0.0	0.0	1.4	7.6
			2003	111	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	61.3	33.3	0.0	3.6	0.0	0.9
			2004	50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	42.0	50.0	0.0	0.0	0.0	2.0
			2005	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.7	83.3	0.0	0.0	0.0	0.0
	2003	3495	2003	182	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	72.5	21.4	0.0	0.5	0.0	0.0
			2004	178	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	54.5	36.5	0.6	0.0	2.2	2.2
			2005	64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	51.5	40.9	0.0	1.5	3.0	0.0

cont'd

Table 5. Cont'd

Release Area	Release year	Number tagged	Recapture year	Adj. Nos. recap'd	% of annual recaptures														
					3K	3LA (Bonavista)	3LB (Trinity)	3LF (Concep'n)	3LJ (E. Avalon)	3LQ (S. Avalon)	3NO (G. Banks)	3PSA (Burgeo N)	3PSB (Fortune)	3PSC (Placentia)	3PSD (Burgeo S)	3PSOFF (offshore)	4RS3PN (N. Gull)	UNK
3PSC	1997	6029	1997	446	0.0	0.0	0.0	0.2	0.2	0.7	0.0	0.0	4.3	94.4	0.0	0.2	0.0	0.0
			1998	472	0.0	0.0	0.0	1.3	4.2	1.1	0.6	0.2	12.9	75.6	0.6	1.5	0.4	1.5
			1999	603	0.3	0.5	0.0	3.2	1.7	1.7	0.0	1.0	6.8	82.6	0.0	1.0	0.0	1.3
			2000	263	0.4	1.1	0.0	0.0	0.8	1.1	0.0	1.5	6.5	81.4	0.0	5.3	0.4	1.5
			2001	69	0.0	0.0	0.0	0.0	0.0	1.4	0.0	1.4	11.6	79.7	0.0	5.8	0.0	0.0
			2002	24	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	25.0	50.0	0.0	16.7	0.0	4.2
			2003	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	80.0	0.0	10.0	0.0	0.0
			2004	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	66.7	0.0	0.0	0.0	0.0
	1998	5716	1998	488	0.0	0.0	0.0	2.0	4.5	1.2	0.0	0.2	1.0	90.2	0.0	0.0	0.0	0.8
			1999	1091	0.4	0.5	0.0	2.5	1.8	1.4	0.0	0.2	4.3	86.6	0.0	0.8	0.0	1.6
			2000	519	0.6	0.2	0.0	0.4	0.4	2.5	0.0	0.8	4.6	88.2	0.0	1.5	0.0	0.8
			2001	157	1.3	0.6	0.0	0.6	1.3	3.8	0.0	0.0	3.8	84.7	0.0	3.2	0.0	0.6
			2002	54	0.0	1.9	0.0	0.0	0.0	9.3	0.0	0.0	0.0	83.3	0.0	1.9	0.0	3.7
			2003	27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.5	77.8	0.0	0.0	0.0	3.7
			2004	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85.7	0.0	0.0	0.0	14.3
	1999	4574	1999	648	0.0	0.0	0.0	0.5	0.8	0.6	0.0	0.0	0.8	97.2	0.0	0.0	0.0	0.2
			2000	754	0.0	0.0	0.0	0.1	0.5	1.2	0.0	0.0	2.9	94.8	0.0	0.1	0.0	0.3
			2001	273	0.0	0.4	0.0	0.7	0.7	2.9	0.0	0.0	2.2	89.0	0.0	2.6	0.0	1.5
			2002	91	0.0	0.0	0.0	0.0	1.1	4.4	0.0	0.0	6.6	84.6	0.0	1.1	0.0	2.2
			2003	28	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	92.9	0.0	3.6	0.0	0.0
			2004	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.7	66.7	0.0	16.7	0.0	0.0
			2005	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
	2000	6191	2000	608	0.0	0.0	0.0	0.0	0.5	1.3	0.0	0.0	1.5	95.4	0.2	0.0	0.0	1.2
			2001	793	0.0	0.0	0.0	0.6	0.8	3.8	0.0	0.1	1.4	91.7	0.0	1.0	0.0	0.6
			2002	310	0.0	0.0	0.0	0.3	0.0	2.9	0.0	0.3	3.5	87.1	0.3	4.2	0.0	1.3
			2003	120	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	1.7	93.3	0.0	3.3	0.0	0.8
			2004	38	0.0	0.0	0.0	2.6	2.6	0.0	0.0	2.6	0.0	73.7	7.9	10.5	0.0	0.0
			2005	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	76.9	0.0	23.1	0.0	0.0
	2001	4326	2001	646	0.2	0.2	0.0	1.2	0.6	4.6	0.0	0.0	1.1	89.0	0.0	0.9	0.0	2.2
			2002	495	0.2	0.2	0.0	0.6	0.6	0.8	0.0	0.6	1.0	92.9	0.0	1.4	0.0	1.6
			2003	202	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	2.0	91.6	0.0	4.5	0.0	1.5
			2004	52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	96.2	0.0	1.9	0.0	0.0
			2005	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	81.0	0.0	14.3	0.0	4.8
	2002	4907	2002	566	0.0	0.0	0.0	0.2	0.0	1.2	0.0	0.2	0.0	96.2	0.0	0.0	0.0	0.2
			2003	643	0.0	0.0	0.0	0.2	0.0	0.5	0.0	0.0	2.0	95.8	0.0	1.1	0.0	0.5
			2004	253	0.4	0.0	0.0	0.0	0.0	0.4	0.0	0.4	0.4	96.8	0.0	0.4	0.0	1.2
			2005	42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91.1	0.0	8.9	0.0	0.0
	2003	5706	2003	584	0.0	0.0	0.0	0.2	0.0	0.2	0.0	0.0	0.3	99.0	0.0	0.2	0.0	0.2
			2004	501	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.4	1.0	97.6	0.0	0.4	0.0	0.0
			2005	129	0.0	0.0	0.0	0.0	1.5	0.0	0.0	1.5	0.0	93.9	0.0	3.1	0.0	0.0

cont'd.

Table 5. Cont'd.

Release Area	Release year	Number tagged	Recapture year	Adj. Nos. recap'd	% of annual recaptures													
					3K	3LA (Bonavista)	3LB (Trinity)	3LF (Concep'n)	3LJ (E. Avalon)	3LQ (S. Avalon)	3NO (G. Banks)	3PSA (Burgeo N)	3PSB (Fortune)	3PSC (Placentia)	3PSD (Burgeo S)	3PSOFF (offshore)	4RS3PN (N. Gulf)	UNK
3PSD	1998	1352	1998	48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	10.4	27.1	2.1	2.1	45.8	2.1
			1999	63	1.6	0.0	0.0	0.0	0.0	0.0	0.0	12.7	4.8	14.3	0.0	1.6	60.3	4.8
			2000	25	4.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0	4.0	8.0	0.0	4.0	60.0	4.0
			2001	13	0.0	0.0	0.0	7.7	0.0	7.7	0.0	0.0	0.0	7.7	0.0	7.7	69.2	0.0
			2002	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
			2004	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	50.0	0.0
	1999	464	1999	38	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.1	10.5	23.7	2.6	10.5	7.9	2.6
			2000	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	31.3	31.3	0.0	25.0	0.0
			2001	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
			2002	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	14.3	28.6	28.6	14.3
			2003	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
	2001	1665	2001	119	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.6	1.7	5.9	14.3	9.2	43.7	12.6
			2002	59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	11.9	10.2	1.7	8.5	57.6	1.7
			2003	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.7	33.3	0.0	0.0	33.3	16.7
			2004	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	10.0	20.0	10.0	0.0	50.0	0.0
			2005	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	20.0	0.0	0.0	20.0	40.0
	2002	963	2002	18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	22.2	11.1	5.6	0.0	55.6	0.0
			2003	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.4	11.1	0.0	22.2	0.0	22.2	0.0
			2004	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	20.0	0.0	0.0	40.0	20.0
			2005	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	66.7	0.0
	2003	878	2003	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	8.3	8.3	0.0	8.3	50.0	16.7
			2004	15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	13.3	6.7	13.3	20.0	13.3	13.3
			2005	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	33.3	0.0	33.3	0.0	0.0
3PSG	2003	511	2003	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			2004	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	0.0	75.0	0.0	16.7
			2005	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	75.0	0.0	0.0
3PSH	1998	1842	1998	29	0.0	0.0	0.0	3.4	0.0	0.0	3.4	0.0	0.0	24.1	0.0	69.0	0.0	0.0
			1999	29	0.0	0.0	0.0	3.4	3.4	0.0	0.0	0.0	0.0	34.5	0.0	51.7	3.4	3.4
			2000	19	0.0	0.0	0.0	0.0	5.3	0.0	0.0	0.0	5.3	26.3	0.0	57.9	0.0	5.3
			2001	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.9	0.0	42.9	0.0	14.3
			2002	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	0.0	60.0	0.0	20.0
			2003	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
			2005	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0	0.0
	1999	1909	1999	47	2.1	0.0	0.0	0.0	8.5	2.1	4.3	0.0	0.0	42.6	0.0	31.9	0.0	8.5
			2000	58	0.0	0.0	0.0	5.2	0.0	1.7	1.7	0.0	0.0	22.4	5.2	44.8	0.0	19.0
			2001	24	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	4.2	29.2	0.0	54.2	0.0	8.3
			2002	16	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0	43.8	0.0	31.3	0.0	18.8
			2003	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.6	0.0	42.9	0.0	28.6
			2004	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	40.0	40.0
	2000	1044	2000	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	50.0	0.0	0.0
			2001	16	0.0	0.0	0.0	0.0	0.0	6.3	18.8	0.0	0.0	6.3	0.0	50.0	0.0	18.8
			2002	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0
			2003	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
			2004	2	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0
			2005	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
	2001	1145	2001	12	0.0	0.0	0.0	0.0	0.0	8.3	8.3	0.0	0.0	16.7	0.0	58.3	0.0	8.3
			2002	16	0.0	0.0	0.0	0.0	6.3	0.0	0.0	0.0	0.0	18.8	0.0	50.0	0.0	25.0
			2003	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0.0	50.0	0.0	25.0
			2004	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0
			2005	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.7	0.0	33.3
	2002	1503	2002	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.5	0.0	64.7	0.0	11.8
			2003	16	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0	37.5	0.0	31.3	0.0	25.0
			2004	12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	8.3	0.0	58.3	0.0	25.0
			2005	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	66.7	0.0	0.0
	2003	621	2003	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	0.0	33.3	0.0	33.3
			2004	8	0.0	0.0	0.0	0.0	0.0	0.0	12.5	0.0	0.0	37.5	0.0	37.5	0.0	12.5
			2005	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.1	0.0	81.8	0.0	9.1
	2004	1747	2004	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
			2005	59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.8	0.0	69.5	0.0	1.7

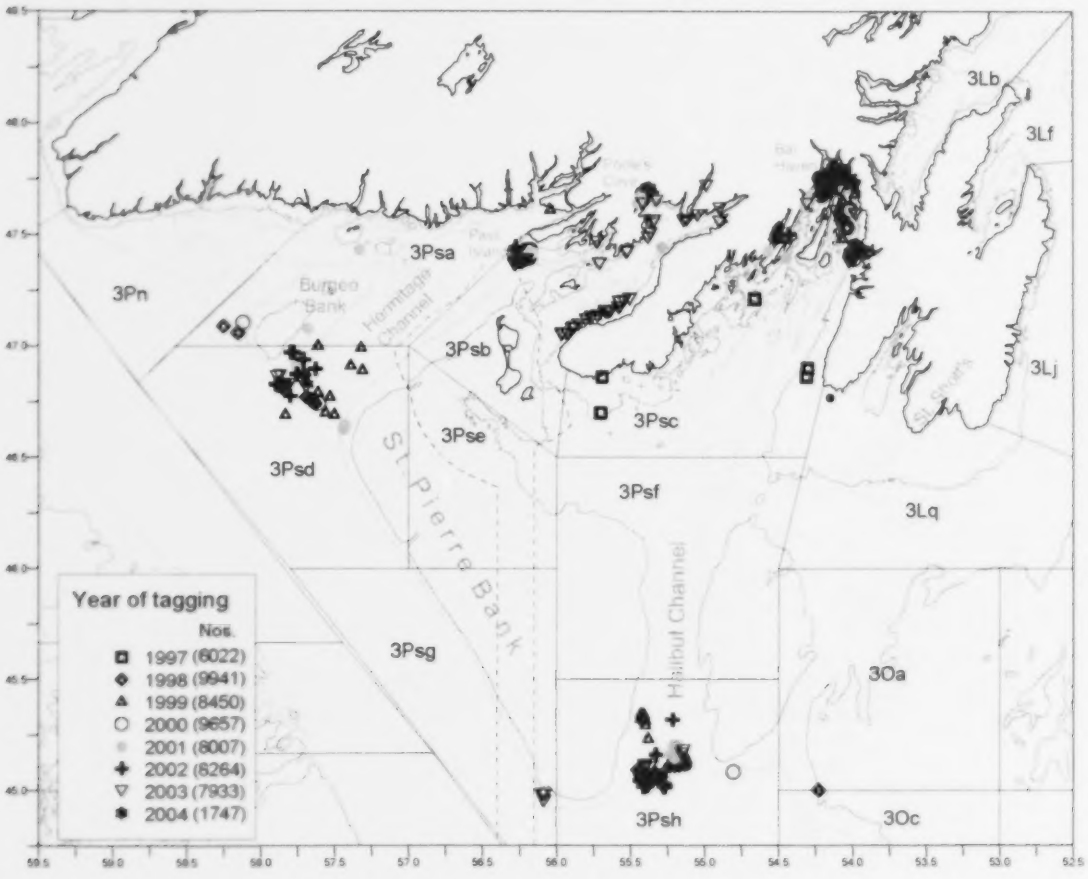

Fig. 1. Locations and total numbers of cod tagged each year off southern Newfoundland during 1997-2004, boundaries of unit areas, 100 m and 200 m depth contours (grey lines), and boundary of French economic zone (dashed line).

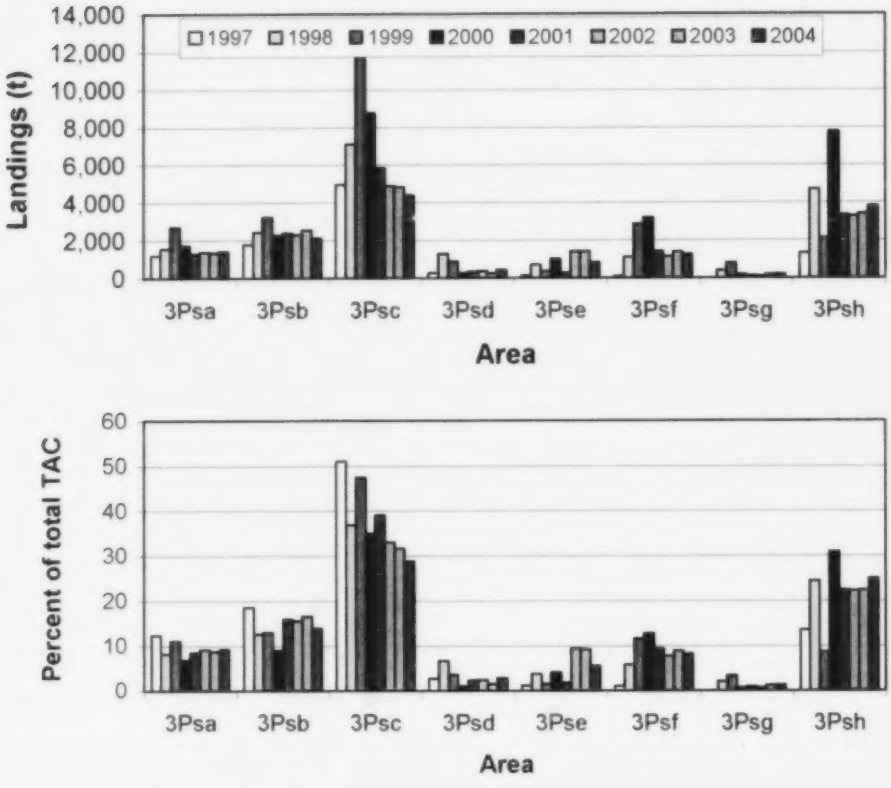

Fig. 2. Annual reported landings of cod by unit area from NAFO Subdiv. 3Ps during 1997-2004.

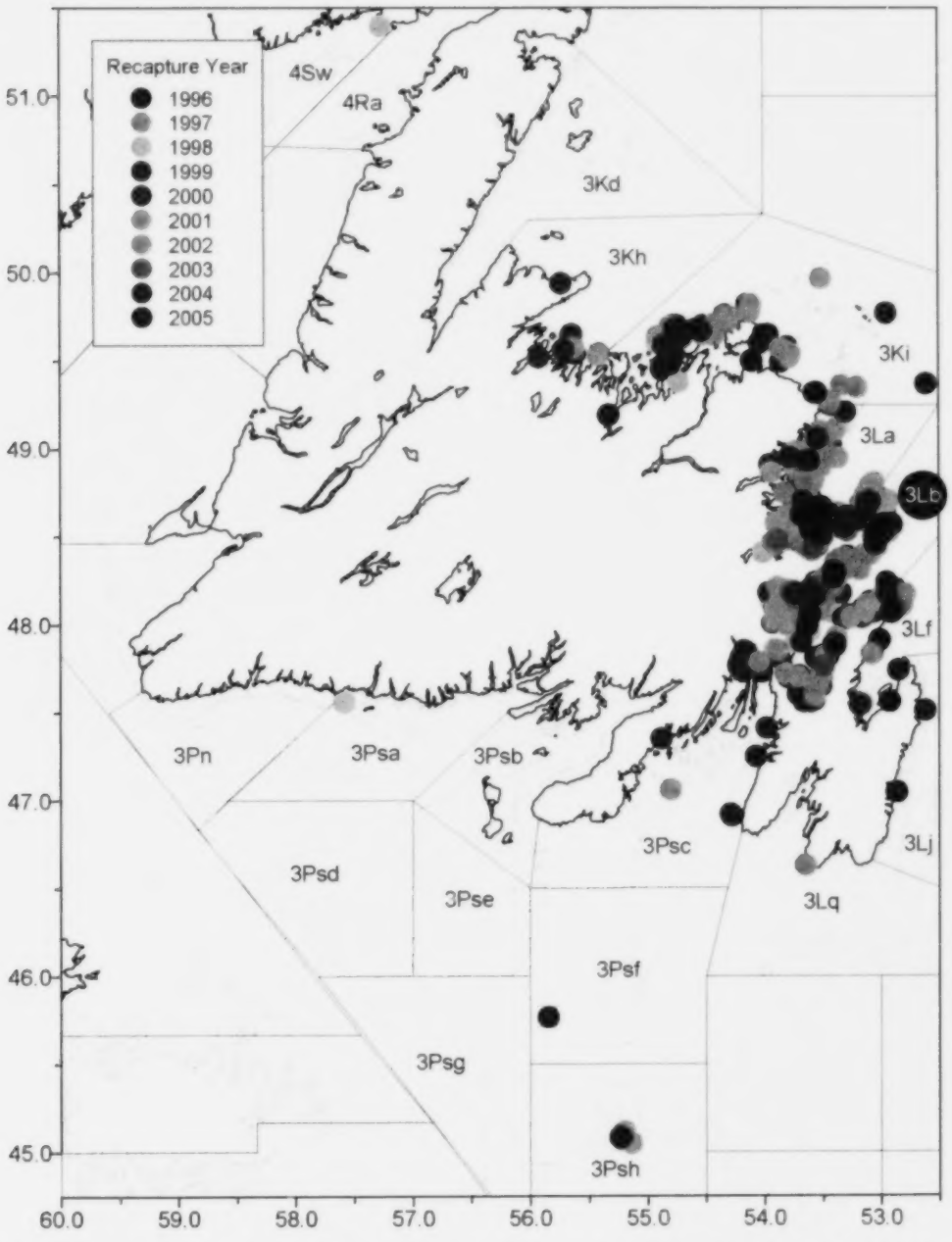

Fig. 3A. Reported recapture positions for cod tagged and released in 3Lb (Trinity Bay) during 1996-2005 (>1,500 recaptures). Boundaries of statistical unit areas (solid lines), the 200 m depth contour (grey line) and French economic zone surrounding St. Pierre and Miquelon (dashed line) are also shown.

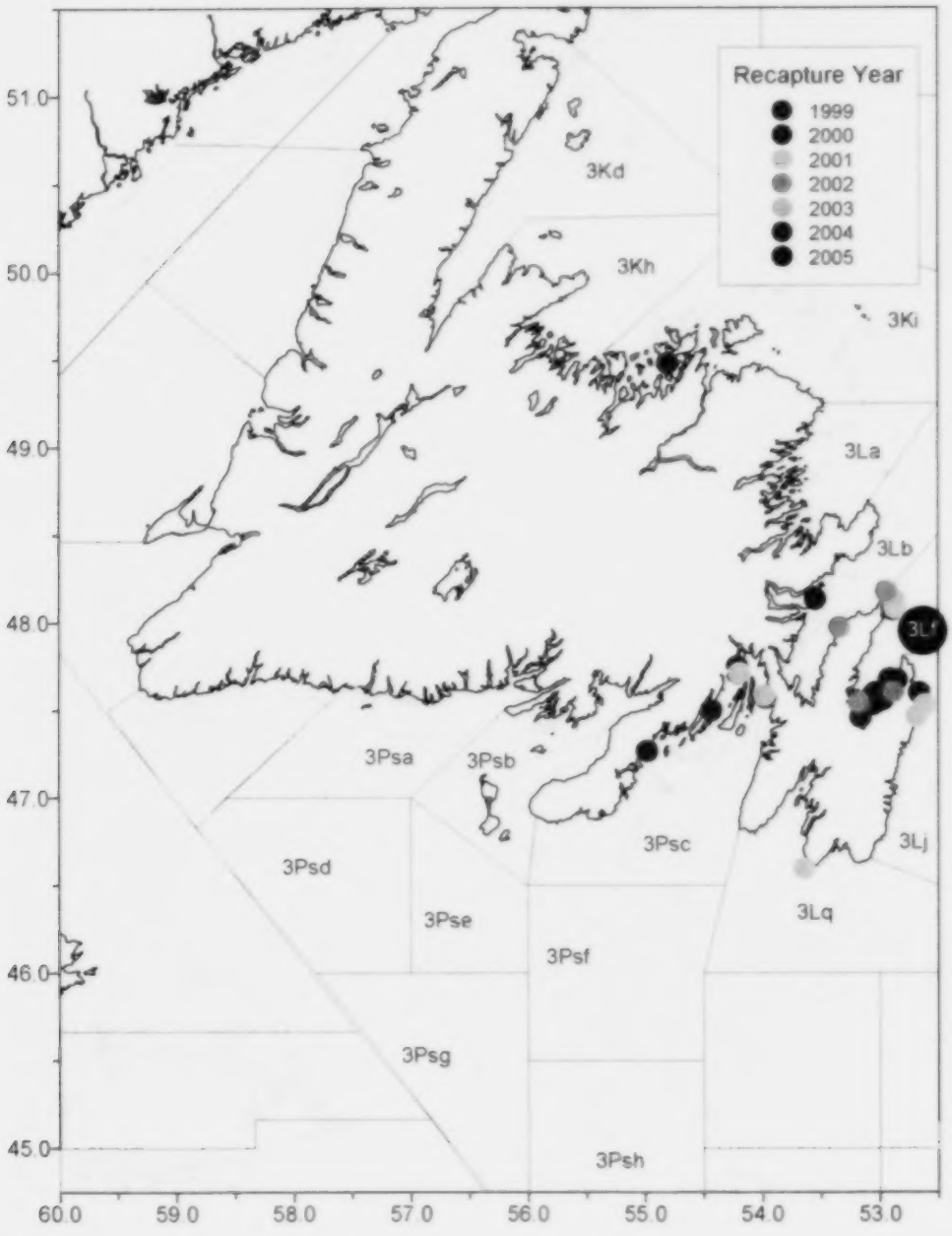

Fig. 3B. Reported recapture positions for cod tagged and released in 3Lf (Conception Bay) during 1999-2000 (46 recaptures). Boundaries of statistical unit areas (solid lines), 200 m depth contour (grey lines), and French economic zone surrounding St. Pierre and Miquelon (dashed line) are also shown.

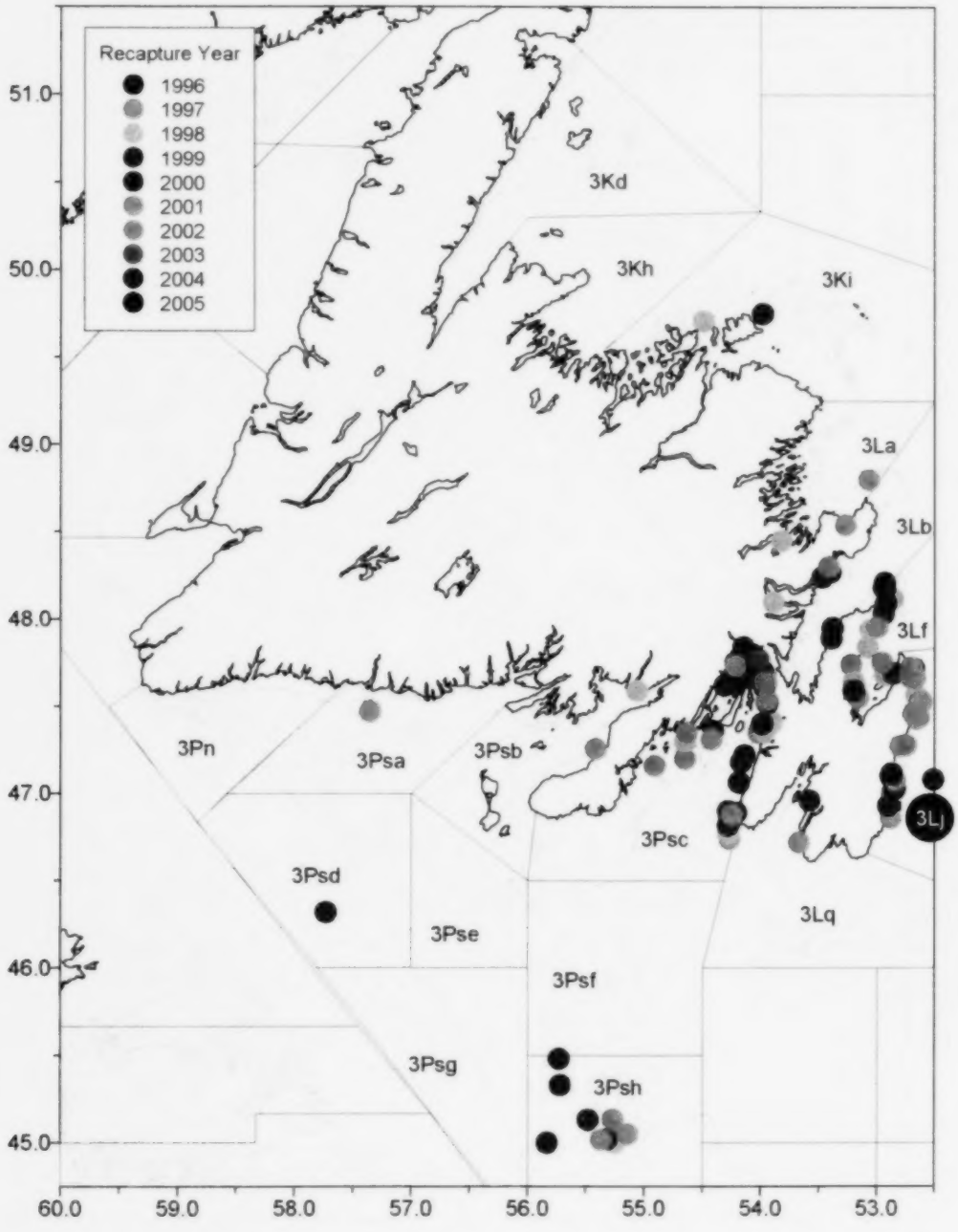

Fig 3C. Reported recapture positions for cod tagged and released in 3Lj (Eastern Avalon) during 1996-2004 (158 recaptures). Boundaries of statistical unit areas (solid lines), 200 m depth contour (grey lines), and French economic zone surrounding St. Pierre and Miquelon (dashed line) are also shown.

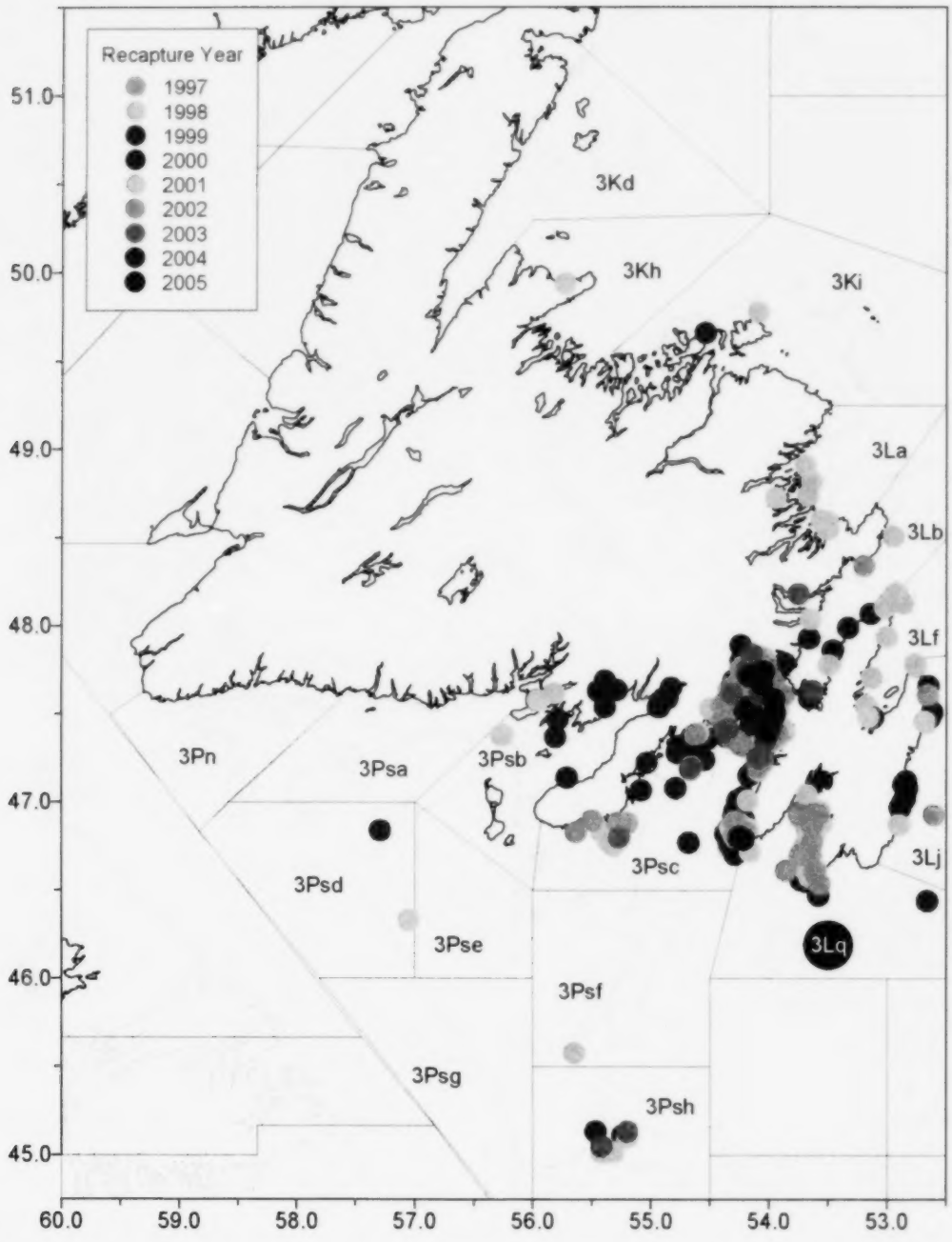

Fig 3D. Reported recapture positions for cod tagged and released in 3Lq (St. Mary's Bay) during 1997-2004 (720 recaptures). Boundaries of statistical unit areas (solid lines), 200 m depth contour (grey lines), and French economic zone surrounding St. Pierre and Miquelon (dashed line) are also shown.

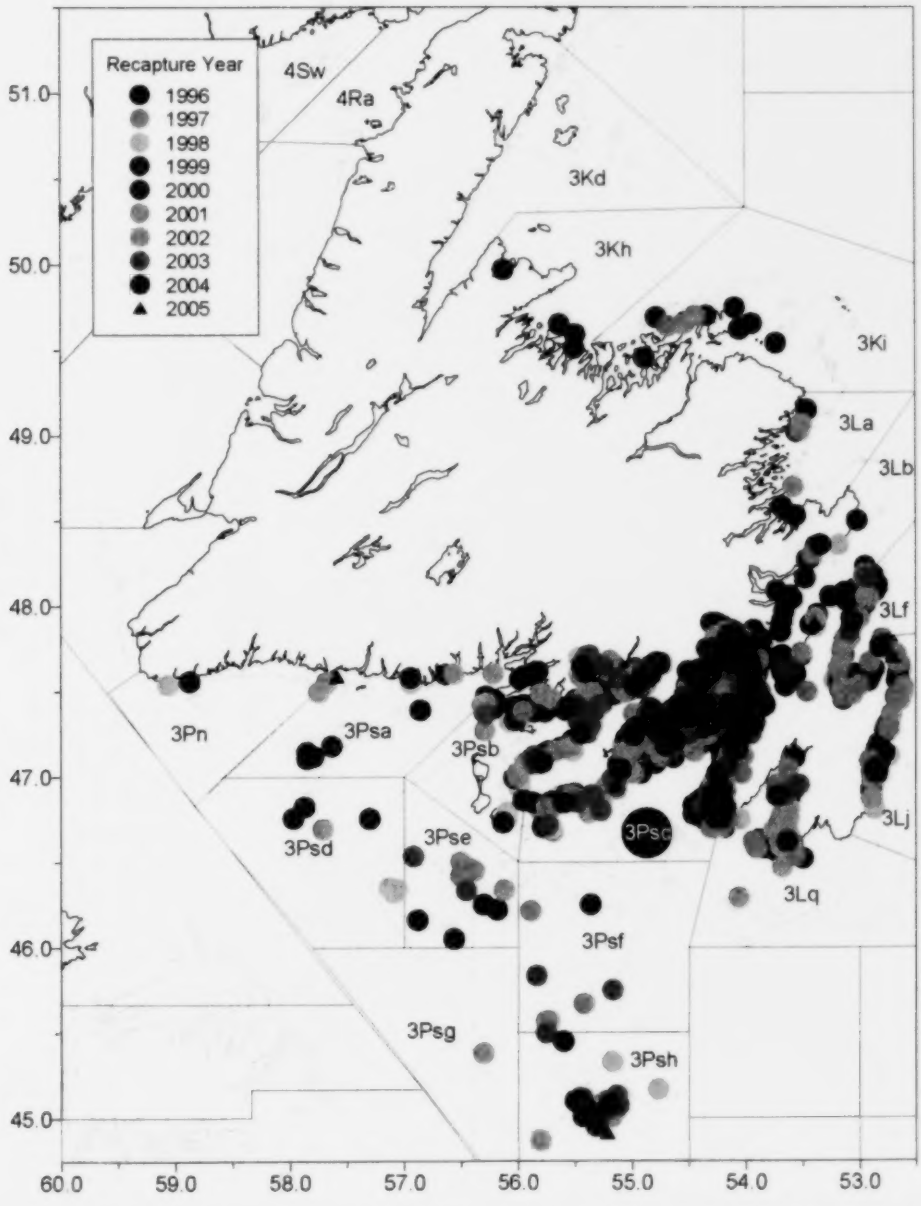

Fig. 3E. Reported recapture positions for cod tagged and released in 3Psc (Placentia Bay) during 1996-2004 (>8,490 recaptures). Boundaries of statistical unit areas (solid lines), the 200 m depth contour (grey line) and French economic zone surrounding St. Pierre and Miquelon (dashed line) are also shown.

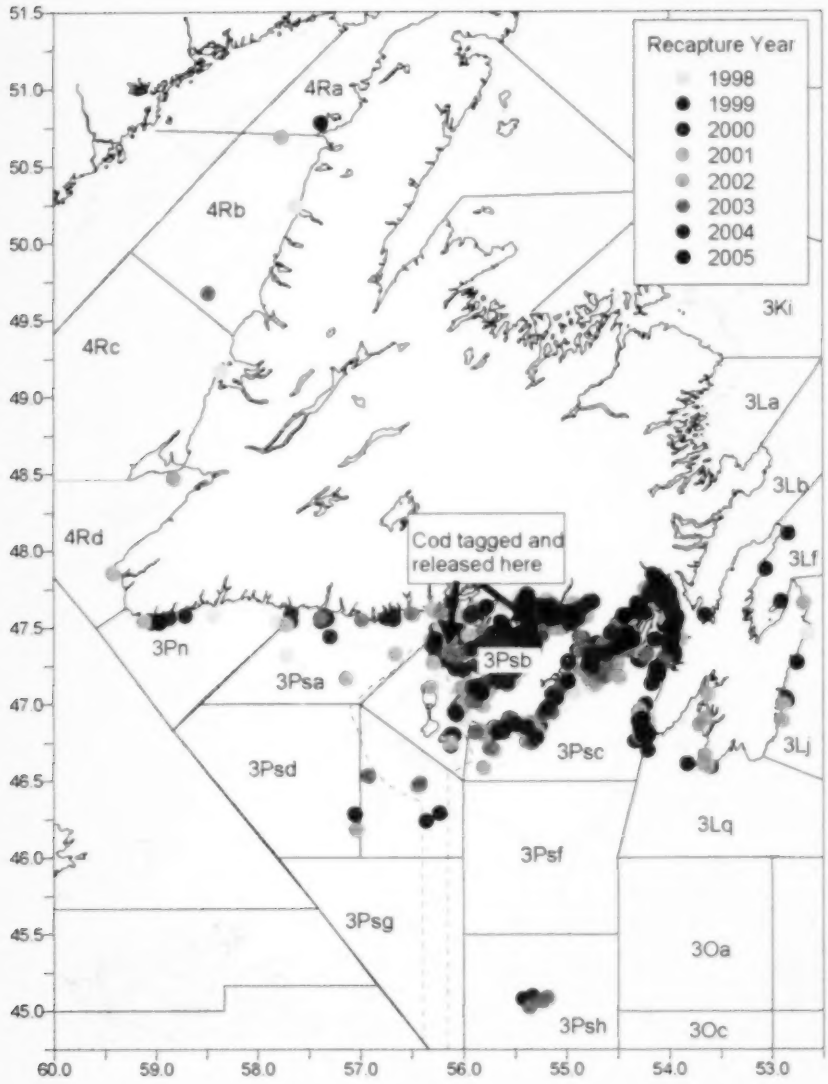

Fig. 3F. Reported recapture positions for cod tagged and released in 3Psb (Fortune Bay) during 1999-2004 (>1,493 recaptures). Boundaries of statistical unit areas (solid lines), the 200 m depth contour (grey line) and French economic zone surrounding St. Pierre and Miquelon (dashed line) are also shown.

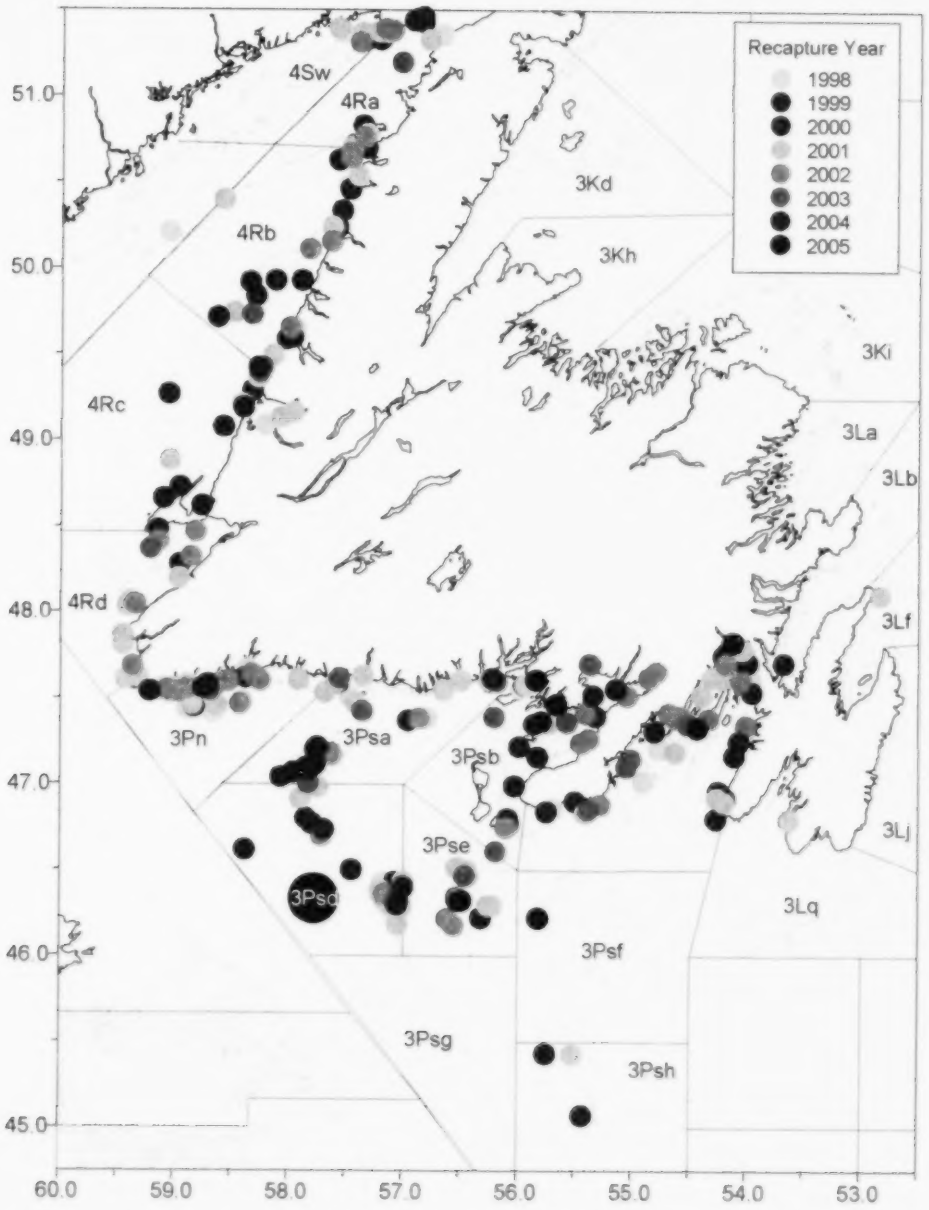

Fig. 3G. Reported recapture positions for cod tagged and released in 3Psd (Burgeo Bank) during 1998-2003 (>290 recaptures). Boundaries of statistical unit areas (solid lines), the 200 m depth contour (grey line) and French economic zone surrounding St. Pierre and Miquelon (dashed line) are also shown.

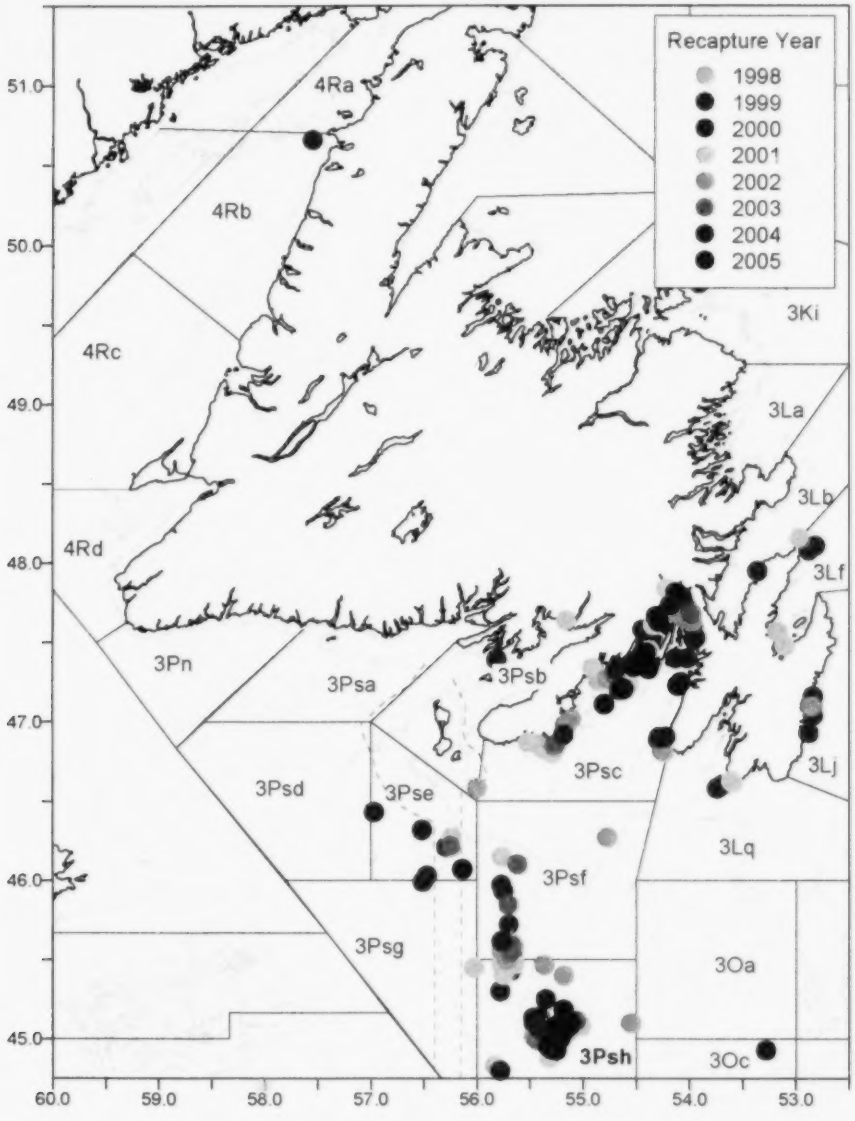

Fig 3H. Reported recapture positions for cod tagged and released in 3Psh (Halibut Channel) during 1998-2004 (275 recaptures). Boundaries of statistical unit areas (solid lines), 200 m depth contour (grey lines), and French economic zone surrounding St. Pierre and Miquelon (dashed line) are also shown.

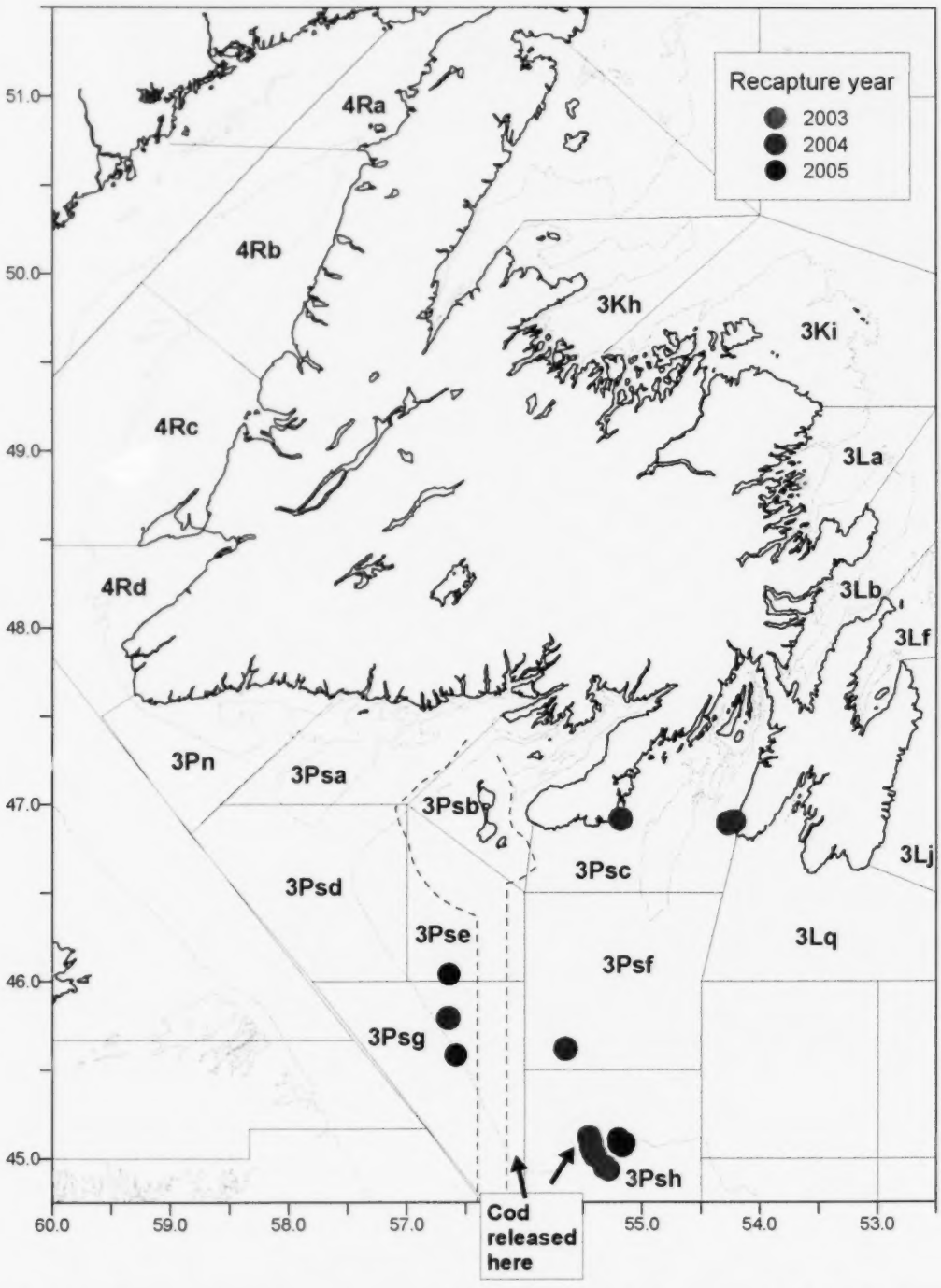

Fig. 4A. Reported recapture positions for cod tagged and released in 3Psh (Halibut Channel) and 3Psg (southern St. Pierre Bank) during 9-10 Dec. 2003 (N=488 and N=511).

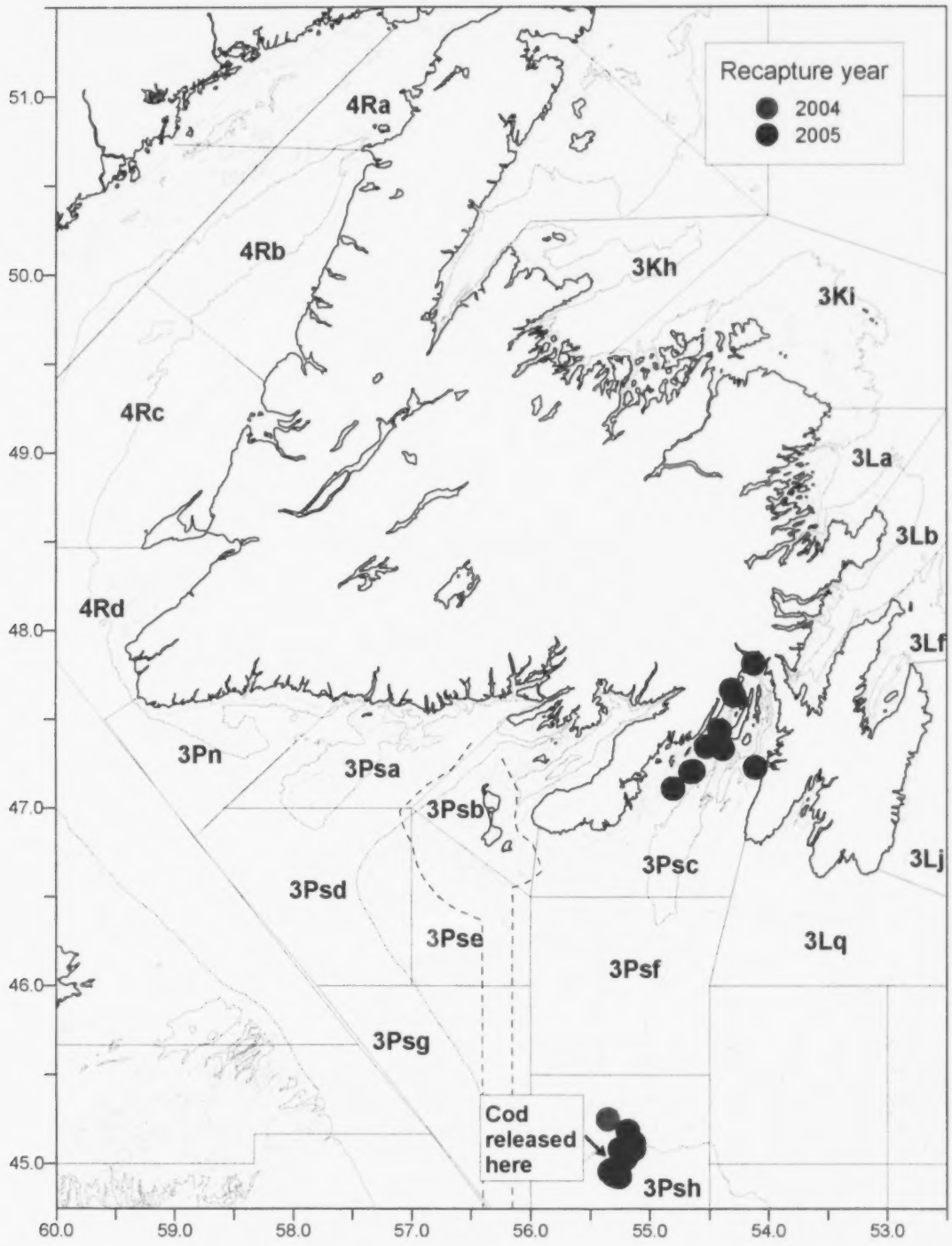

Fig. 4B. Reported recapture positions (dots) for cod tagged and released in southern Halibut Channel (N=1747) during 12-14 Dec 2004.